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FORESTRY IN MADRAS STATE

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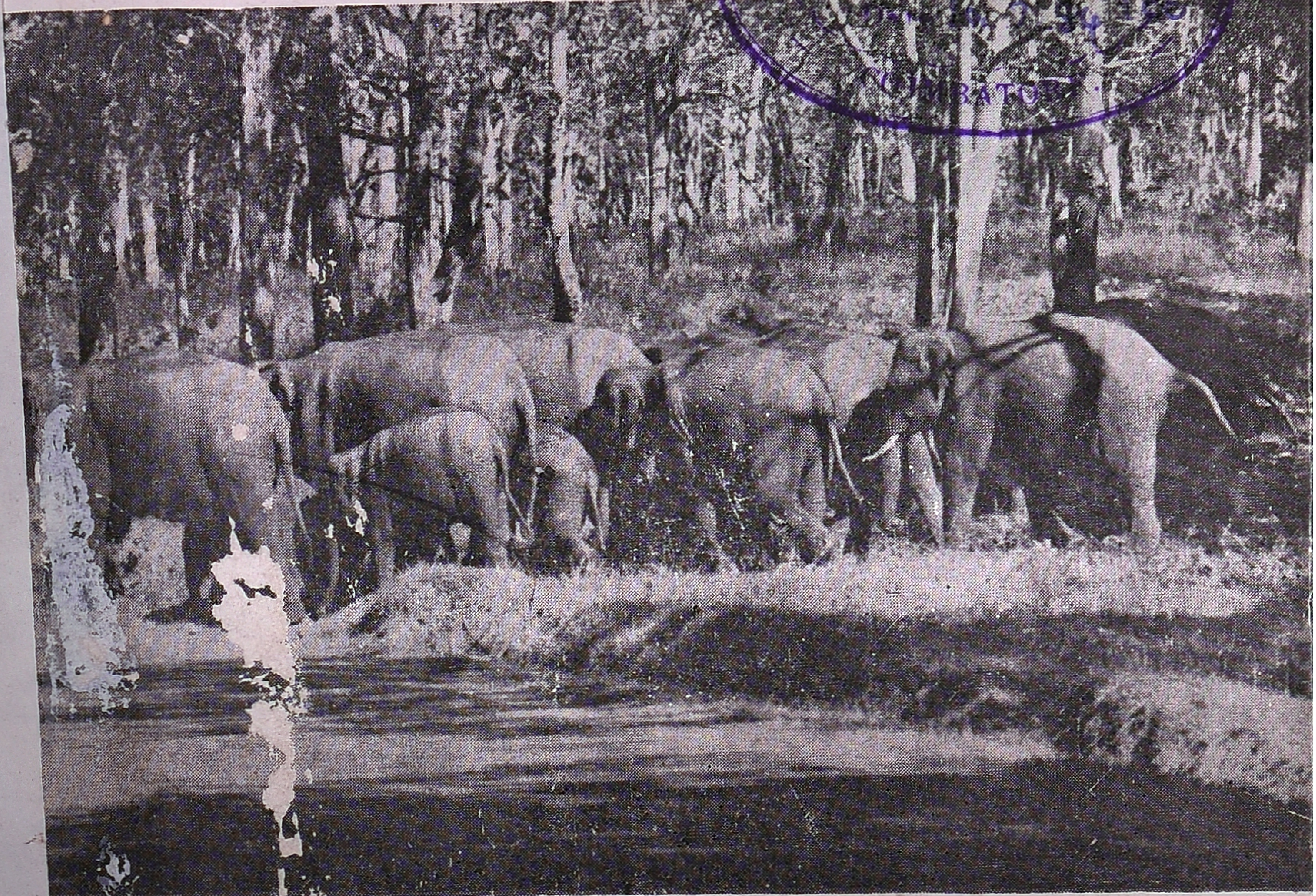

Elephant Herd—Mudumalai Wild Life Sanctuary.

PUBLI[illegible]ED ON THE OCCASION OF THE VISIT OF THE
DELEGATES TO THE IX COMMONWEALTH FORESTRY
CONFERENCE (NEW DELHI) TO MADRAS FORESTS

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TOUR IN MADRAS STATE
(21st to 24th January 1968)

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FORESTRY IN MADRAS STATE

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PUBLISHED ON THE OCCASION OF THE VISIT OF THE
DELEGATES TO THE IX COMMONWEALTH
FORESTRY CONFERENCE (NEW DELHI)
TO MADRAS FORESTS

TOUR IN MADRAS STATE
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Issued by
THE CHIEF CONSERVATOR OF FORESTS
MADRAS

THIRU C. N. ANNADURAI
CHIEF MINISTER

FORT ST. GEORGE
MADRAS-9

Dated, 26th December 1967

MESSAGE

It gives me great pleasure to send to you, Delegates and Observers to the IX Commonwealth Forestry Conference, a message of welcome to places of forestry interest in this State. I hope you will enjoy your visit to this part of the country and like the salubrious climate and sylvan surroundings of the Nilgiris.

Your visit affords a valuable opportunity to exchange the latest information and share the expert knowledge in the field of forestry. All the world over, the demand on forests, both for domestic and for industrial requirements, is increasing day by day. There is, therefore, great need for the better and more efficient management of the existing forest-wealth. The afforestation of the difficult sites which have not so far been put to use, also assumes importance and urgency. I am sure your deliberations at the Conference will help in achieving success in tackling these and other problems connected with forestry.

C. N. Annadurai.

(C. N. ANNADURAI)
Chief Minister.

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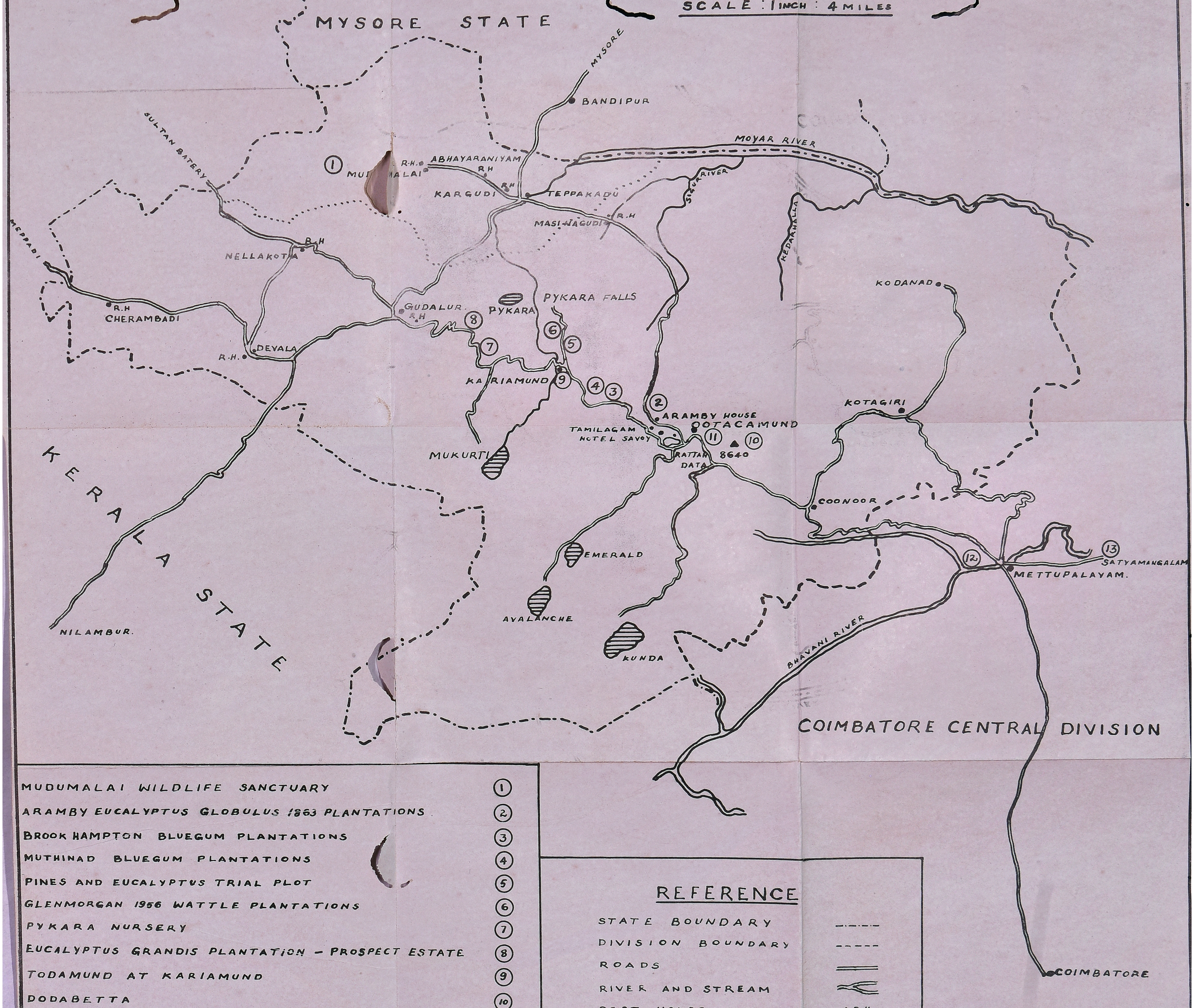
NILGIRI FOREST DIVISION

SCALE : 1 INCH : 4 MILES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BANDIPUR
SULTAN BATERY
MOYAR RIVER
① MUDUMALAI
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TEPPAKADU
SIGUR RIVER
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COIMBATORE

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PROGRAMME

Sunday, 21st January 1968 : Afternoon—	HRS.
Arrive Mudumalai	16-00
Tea at Moyar Waterfalls	16-00 to 16-30
Visit Circular Road, Jeyadev Avenue and Elephant Camp.	16-30 to 18-30
Leave Mudumalai	18-30
Arrive Ootacamund	20-30

(Boarding and Lodging at Tamilagam.)

Monday, 22nd January 1968 : Forenoon— 09-00 to 13-00

Visit to—

(1) Aramby Eucalyptus Globulus 1863 Plantation.
(2) Brookhampton Bluegum Plantation.
(3) Muthinad Bluegum Plantation.
(4) Trial Plots of Pines and Eucalyptus species.
(5) Glenmorgan Wattle Plantation 1956.
(6) Pykara Nursery.
(7) Eucalyptus Grandis Plot—Prospect Estate.
(8) Toda Mund at Kariamund.

Return to Ootacamund	13-00

Monday, 22nd January 1968 : Afternoon—	
To Doddabetta	15-00
Tea at Doddabetta	16-00
To Botanical Gardens and Back to Aranmore	16-30
Dinner	20-00

Tuesday, 23rd January 1968 : Morning—	HRS.
Leave to Ootacamund for Nilambur	08-00
Arrive Nilambur	10-30
Visit to Nilambur Forests and Plantations	10-30 to 16-00
Leave Nilambur	16-00
Arrive Ootacamund	18-30

Wednesday, 24th January 1968—	
Leave Ootacamund (by road)	09-00
Arrive Mettupalayam	11-00
Visit Tan India Wattle Extracts	
Light refreshments by Tan India	
Leave for Sirumugai	12-30
Arrive Sirumugai—Lunch by South India Viscose.	13-00
Visit South India Viscose Rayon and Staple Fibre Industry.	14-00 to 16-00
Leave Sirumugai	16-00
Arrive Coimbatore (Tea at Airport)	17-30
Departure Coimbatore by Air	18-45

Officers connected with the Tour

1. T. Jeyadev, I.F.S., Chief Conservator of Forests, Madras.
2. K.A. Bhoja Shetty, I.F.S., Conservator of Forests, Coimbatore Circle, Coimbatore.
3. M. A. Badshah, I.F.S., State Wild Life Officer, Madras.
4. T. K. Rajagopalan, I.F.S., District Forest Officer, Coimbatore Central, Coimbatore.
5. K. R. Venkatesan, B.Sc. (Hons.), A.I.F.C., District Forest Officer, Nilgiris.
6. Y. S. Kadakshamani, B.A., Assistant Conservator of Forests, Nilgiris.

FORESTRY IN MADRAS STATE

Madras State, with a total land area of 130,357 square kilometres, occupies the south-eastern part of India. It lies between 8° N. and 14° N. latitudes and 76° E. and 81° E. longitudes.

The Western Ghats flank the western boundary of the State. The Nilgiris hills, a massive range with an average elevation of 2,000 metres above sea level, with its highest point, Doddabetta peak 2,633 metres, form the easterly extension of the Western Ghats. Southwards, the Nilgiris hills extend to Coimbatore district to form the Upper Bhavani and Bolampatty Range of hills, abruptly ending at the Palghat gap. South of the gap the Western Ghats rise again forming a spur of the main range of the ghats forming the Anamallai hills of Coimbatore South Forest Division. Continuation of these in Madurai district are the Palani hills. The hills of Tirunelveli and Kanyakumari districts form the southern extremity of the Western Ghats.

At the southernmost end of the State the land tapers to form a promontory at Kanyakumari touching the Indian Ocean.

The Bay of Bengal forms the eastern boundary of the State. On the east coast the low interrupted chain of hills constitute the Eastern Ghats.

The north-east is bounded by Nellore and Chittoor districts of Andhra Pradesh. Along the north-western boundary are the extensions of Mysore plateau forming Hosur and Hassanur plateaux, with a general elevation of 700—1,000 metres.

The drainage is mainly to the east into the Bay of Bengal. The major rivers are the Palar, the Pennar, the Cauvery, the Tambraparani and the Vaigai.

Climate

On the plains the climate is distinguished by high temperatures throughout the year. The term "cold season" is a misnomer here for the early months of the year, since the mean temperature of the coolest month, January is in the region of 24°. April, May and June are the hottest months with a mean temperature of 30°—33°, the maximum touching 40°. In the coastal region the climate is rendered more oppressive on account of high humidity, which ranges from 65 to 80 percent.

At higher elevations the climate is more equable and above 2,000 metres the climate is distinctly temperate. Ootacamund situated at an altitude of 2,245 metres in the Nilgiris, has a mean annual temperature of 14.2°, with annual mean maximum of 18.9° and annual mean minimum of 9.4°. Frost is common between November and February.

Rainfall

The rainfall pattern over the bulk of the area of Madras State is very different from that of the rest of India by the fact that most of the rain is received from October to December during the retreat of the monsoon rather than during the principal monsoon period of June to September.

Low rainfall is the general feature of the State, which is attributable to the feeble effect of the principal south-west monsoon over the region. On the plains the annual rainfall seldom exceeds 1,250 millimetres and over a major portion it is less than 900 millimetres. The coastal region in the east receives comparatively heavier rainfall of 1,000 to 1,250 millimetres but in the inland areas it is generally between 600 to 900 millimetres.

The hill ranges along the western boundary experience heavy rainfall, in places as high as 7,000 millimetres, although over most portions the annual rainfall is generally about 2,000 millimetres. Here the rainfall is received from both south-west and north-east monsoons, the former contributing the bulk of the precipitation.

The Forests

The total area of State forests is 21,033 square kilometres which is approximately 16 per cent of the total land area. The extent of private forests is small.

The wide variations in the climate, ranging from the tropical to the temperature, with rainfall as low as 600 millimetres on the semi-arid plains to over 5,000 millimetres on the Western Ghats, contribute to a diverse variety of natural vegetation. Following are the main forest types :—

(*a*) *Southern tropical wet evergreen forests.*—These form the characteristic vegetation of the Western Ghats. The annual rainfall is generally from 2,000 millimetres upwards. The dry season is not usually prolonged, only 2 to 4 months having less than 50 millimetres.

The vegetation is characterised by a rich wealth of species. The canopy is extremely dense. Lofty trees, 45 metres or even more, with long cylindricall boles, usually with thin smooth bark and with plank buttresses, form the upper canopy. Although occasionally a few species may occur in associations, nowhere does any species tend to be gregarious.

The chief commercial species are *Hopea parviflora, Mesua ferrea, Calophyllum elatum, Palaquium ellipticum Dysoxylum malambaricum, Cedrela toona, Cullenia excelsa, Vateria indica.*

(*b*) *South Indian moist deciduous forests.*—This type is frequently found on the lower slopes of the Western Ghats, the Nilgiris, Anamallais and Palani hills. The rainfall is 1,500 to 2,000 millimetres with a dry season of 4 to 5 months.

The forests form a closed canopy with dominant trees 30 metres or more in height. The chief feature of the moist deciduous forests is a leafless period in the dry season, from February to April, when the upper Canopy is entirely leafless though there is a good sprinkling of evergreens in the understory.

Teak (*Tectona grandis*) is the most characteristic species. The usual associates of teak in the top canopy are *Terminalia* species, *Dalbergia latifolia, Anogeissus latifolia, Pterocarpus marsupium, Lagersrtpemia lanceolate, Adina cordifolia, Mitragyna parviflora, Stereospermum species, Grewia tiliaefolia, Dillenia, pentagyna, Salmalia malabarica, Schleichera oleosa.* The typical bamboo is *Bambusa arundinacea* but on drier sites *Dendrocalamus strictus* replaces the former.

(*c*) *Southern tropical dry deciduous forests.*—This type is usually found on the lower slopes of the Nilgiris, Anamallais and Palani hills and also on the plateux of Javadis, Hassanur and Hosur. The annual rainfall is 1,000 to 1,200 millimetres. The hill slopes along the western boundary receive their rainfall both from the south-west and the retreating monsoon.

The upper canopy of the forest is formed by a mixture of species practically all of which are deciduous during the dry season, usually for several months, though some for a short period only. Height is typically 13 to 20 metres. The lower canopy is likewise almost entirely deciduous. Fires are a common feature over much of these forests during summer. Repeated fires result in an open canopy with a few species such as *Anogeissus latifolia, Terminalia chebula and Phoenix acaulis,* the ground being covered with dense, tall grass.

Common species in the top canopy are *Tectona grandis, Anogeissus latifolia, Terminalia tomentosa, Terminalia Chebula, Terminalia belerica, Pterocarous marsupium, Lannea grandis, Bridelia retusa, Dalbergia latifolia* and occasionally *Salmalia malabarica.* The chief bamboo in this type is *Dendrocalamus strictus.*

Sandal.—Forming a sub-type are the sandal (*Santalum album*) forests occurring over extensive tracts on the Javadi and Hassanur plateux, at elevations from 800 to 1,200 metres. Sandal is a species of deciduous associate formations, especially of the bush type, and it may be that it is a transitory species occurring in a preclimax vegetation.

Other common species in the sandal forests are *Canthium didymum, Chloroxylon swietenia, Erythroxylon monogymum, Premna tomentosa, Zizyphus Xylopyrus, Acacia* species *Atalanitia monophylla, Strychnos potatorum, Ixora parviflora, Pterocarpus marsupium, Diospyros montana Albizzia* species, etc.

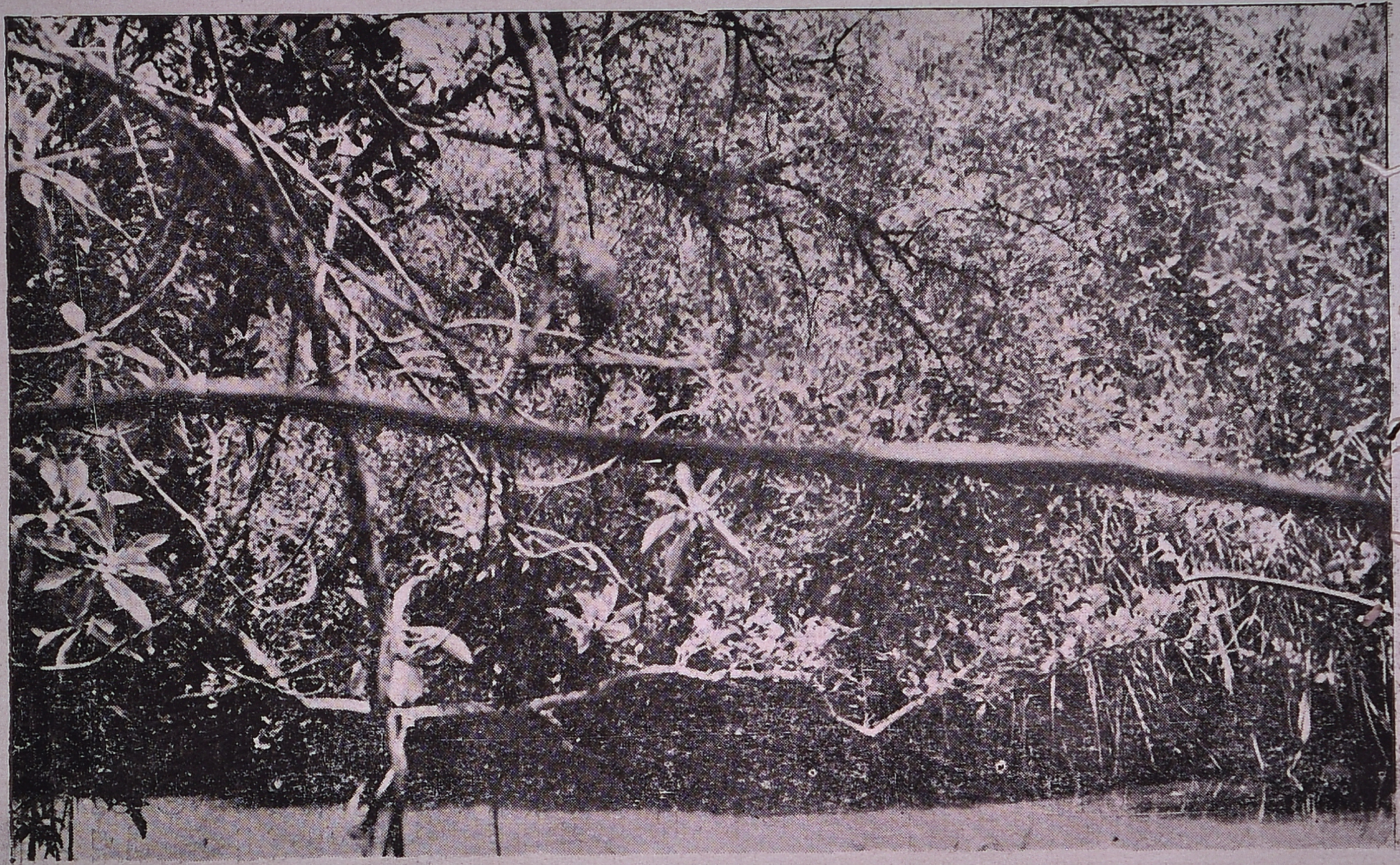
Economically sandal is the most important species contributing nearly fifty per cent of the forest revenue. However, the stock of sandal is getting depleted at a fast rate due to a virus disease, known as *spike*. Grazing and repeated fires are other factors which effectively retard the spread of natural sandal. Sandal plantations are being raised under the 'kumri' method with successful results.

(*d*) *Southren tropical thorn forests.*—This is the predominant forest type of the State and is characteristic of the semi-arid plains. Annual rainfall over the greater part is below 800 millimetres and in some places as low as 500 to 600 millimetres. Most of the rainfall is received from the retreating monsoon during October to December.

It is an open low type of forest in which thorny usually hardwooded species predominate, *Acacia* species being particularly characteristic. The trees usually have short boles and low branching crowns which rarely meet. The usual height is 6 to 9 metres. There is an ill-defined lower story of smaller trees and large shrubs, mostly spiny and often with other xerophytic characters.

Trees in the upper canopy are usually *Acacia latronum, Acacia leucophloea, Acacia arabica, Azadirachta indica, Dichrostachys cinerea, Zizyphus species, Chloroxylon swietenia, Canthium didymum.*

(*e*) *Tropical dry evergren forests.*—This type is restricted to the east coast where the rainfall is largely from the retreading North-east monsoon. Annual rainfall is 900 to 1,200 millimetres with maximum falls in October and November. The mean humidity for the year is about 80.



Mangrove Forests—Pitchavaram Cuddalore South Forest Division

The dry evergreen forest is a close canopied, low forest 9 to 12 metres high, containing evergreen trees characterised by short boles, spreading crowns and coriaceous leaves. There is no marked differentiation of canopy layers between the shrubby underwood which includes many spiny species and the top canopy.

The common trees are *Manikara hexandra, Mimusops elangi, Zizyphus Xylopyrus, Acacia leucophloea, Buchnania angustifolia, Randia dumatorum, Strychnos nux vomica, S. potatorum, Sapindus emarginatus.*

(*f*) *Tidal swamp forests.*—The estuaries on the east coast contain the mangrove forests, which are a distinctive type of vegetation with characteristics peculiar to this type alone. Successive depositions of alluvial silt brought down by the rivers to the sea front result in gradual elevation of the ground which in due course begins to be exposed at low tide but submerged during high tide. This is the lower most zone of accretion where mangroves appear.

It is a closed evergreen forest 5 to 10 metres high composed chiefly of a few species specially adapted to survive the rigorous conditions of physiological drought. Pueumatophores, vivipary and stilt roots are some of the adaptations exhibited by the mangrove species to establish themselves under adverse edaphic factors.

The common tree species are Avicennia species, *Bruguiera officinalis, Excoecaria agallocha.*

The distribution of species is dependent on tidal action. Areas subjected to inundation are colonized by *Avicennia* species and *Rhizophora* species. As the deposition of silt progresses and the ground level rises, these are replaced by other species, principally *Excoecaria agallocha.*

(*g*) *Southern montane wet temperate forests.*—They occur at higher elevations, from about 1,500 metres upwards in the Nilgiris, Upper Palani, Anamallais and Tirunelveli hills. The annual rainfall is 1,500 to 6,000 millimetres or more.

Locally known as *sholas,* these forests occupy the sheltered folds in the hills and heads of rivers, forming sharply defined blocks in the vast stretches of rolling downs. The species are all evergreen, the trees being mostly short-boled and branchy. The height of the forest is relatively low, rarely exceeding 6 metres. The crowns are usually very dense and rounded which foliage which tend to be red to a varying degree when young, giving a range of colours which is one of the most conspicuous features of the type. The branches are clothed with mosses, ferns and other epiphytes and woody climbers are common.

The flora is a varied one including elements of tropical as well as temperate origin. The species in the sholas are numerous, the most common being *Ternstroemia japonica, Syzigium* species, *Michelia nilagirica, Gordonia obtusa, Meliosma wightii, Elaeocarpus* species, *Photinia* species, *Cinnamomum wightii, Litsea wightina, Neolitsea Zeylanica Ilex* species.

Past system of management of the forests

In the ancient times, before the British rule, nothing in the way of forest management seems to have been attempted. Undoubtedly vast stretches of natural woodlands remained remote and beyond the impact of human influence. Even after the advent of the British the forests attracted but little attention until the middle of the 18th century when the setting up of the defence establishments, namely the Naval dockyard in Bombay and the military barracks in Madras and Wellington, gave a great impetus to the large scale extraction of teak. From about 1850, Army Officers were appointed to supervise the timber exploitation in Anamallais and Nilgiris. The Mudumalai forests which were the property of the Tirumalpad of Nilambur, were taken over on lease in 1857 to supply teak timber for the construction of Government buildings at Wellington and Ootacamund. The Mudumalai forests were subsequently acquired as State Forests in 1927 by paying compensation to the owner.

Elsewhere the people were permitted to fell and remove without permission or payment, wood for agricultural implements and fuel for domestic consumption. Timber when felled was subject to a tax which, in the absence of all supervision, was easily evaded.

Forest Conservancy in the State began with the appointment of Dr. Cleghorn as the Conservator of Forests in 1856. The Board of Revenue was then in over-all charge of forest administration.

With a view to prevent the unrestricted felling of wood and to conserve the more valuable trees from the danger of extinction and also to bring uniformity in the treatment of forest produce throughout all the districts, the Board of Revenue issued a simple set of rules called the Jungle Conservancy Rules in 1860. According to these rules felling of timber trees, exceeding 3 feet in circumference at 2 feet from ground level and all "reserved" trees in the State forests was prohibited except with the permission of specified officers. A list of "reserved" trees was also notified. The rules also provided certain restrictions regarding removal of fuel and charcoal burning. Seigniorage fees at different rates were fixed for the removal of various items of forest produce. The revenue collected from these sources was allotted to the Jungle Conservancy Fund and was to be expended towards improvements to the forests.

The task of collecting the revenue and supervising the removals soon proved too much for the meagre staff and the system served at best only as a slight check on the extensive denudation of tree growth that was taking place on the plains.

In 1882 the Madras Forest Act was introduced and thereafter the State forests were demarcated, mapped and reserved under the Act. The emphasis till then was on consolidation and conservation of the forests and the Act provided an effective tool to enforce rigid protection.

While forest administration was entrusted to a specialised organization from 1856, the Forest Department itself became a separate entity of Government only from 1919 when Mr. Cox was appionted the first Chief Conservator of Forests.

In 1914 certain reserved forests near villages which were intended mainly to meet the requirements of villagers for grazing and fuel were transferred to the control of forest panchayats in a few districts. In 1923 a Retrenchment Committee recommended the classification of the reserved forests into ' major ' and ' minor '. The major forests only were to remain under the control of the Forest Department, while the minor forests, where the dominant demand is for grazing and fuel requirements of the local population, were to be transferred to the forest panchayats. The transfer of these forests to the panchayats took place in 1925.

The forest panchayats were functioning only under the nominal control of the Revenue Department, with the result scarcely any attention was paid to the conservation of the forests. Unregulated fellings and illicit removals depleted the forests rapidly. It took some time to realize the folly of this system of management and the control of the minor forests was eventually retransferred to the Forest Department from 1949 onwards.

The Second World War threw a heavy burden on the forests. In order to meet the enormous war demands for timber, firewood and charcoal, over exploitation had to be necessarily resorted to, setting aside the prescriptions of the working plans.

The earliest attempts at raising forest plantations were in the Nilgiris in the early forties of the 19th century, when Australian wattles and bluegum were introduced. These species were introduced in the Upper Palanis also, later on, during 1883–84. The object in both cases was to find suitable species to meet the local demand for firewood.

Over exploitation of teak, by selective felling, in the early 19th century, began to cause anxiety since natural regeneration was deplorably inadequate to replenish the stock. Trials with artificial regeneration were started in Mount Stuart in Coimbatore South in 1856 but no traces of these attempts are visible now. The oldest existing plantation in Coimbatore South Division was formed in 1872. Teak plantation, over a small extent, was also raised in Velancombai of Madurai division in 1866-67. However, these were only sporadic trials which did not lead to any regular programme of teak planting. It was only from about 1910 that systematic planting of teak was commenced in Mudumalai and Mount Stuart.

After independence, with the rapid industrialization of the country, the inadequacy of the existing forest resources became very apparent. The need for increasing the productivity of the forests in order to meet the growing demand for timber, fuelwood, industrial raw materials, etc., was keenly felt.

In order to increase the productivity of the forests, large scale plantations of Teak, Eucalyptus, Wattle, Softwoods, Cashew, Casuarina and Bamboos were undertaken in suitable areas as per the prescriptions of the Working Plan for each forest division.

The tempo of planting programme was intensified under the Five Year Plans. The achievements under each plan period are furnished below :—

First Five-year Plan (1951-56)

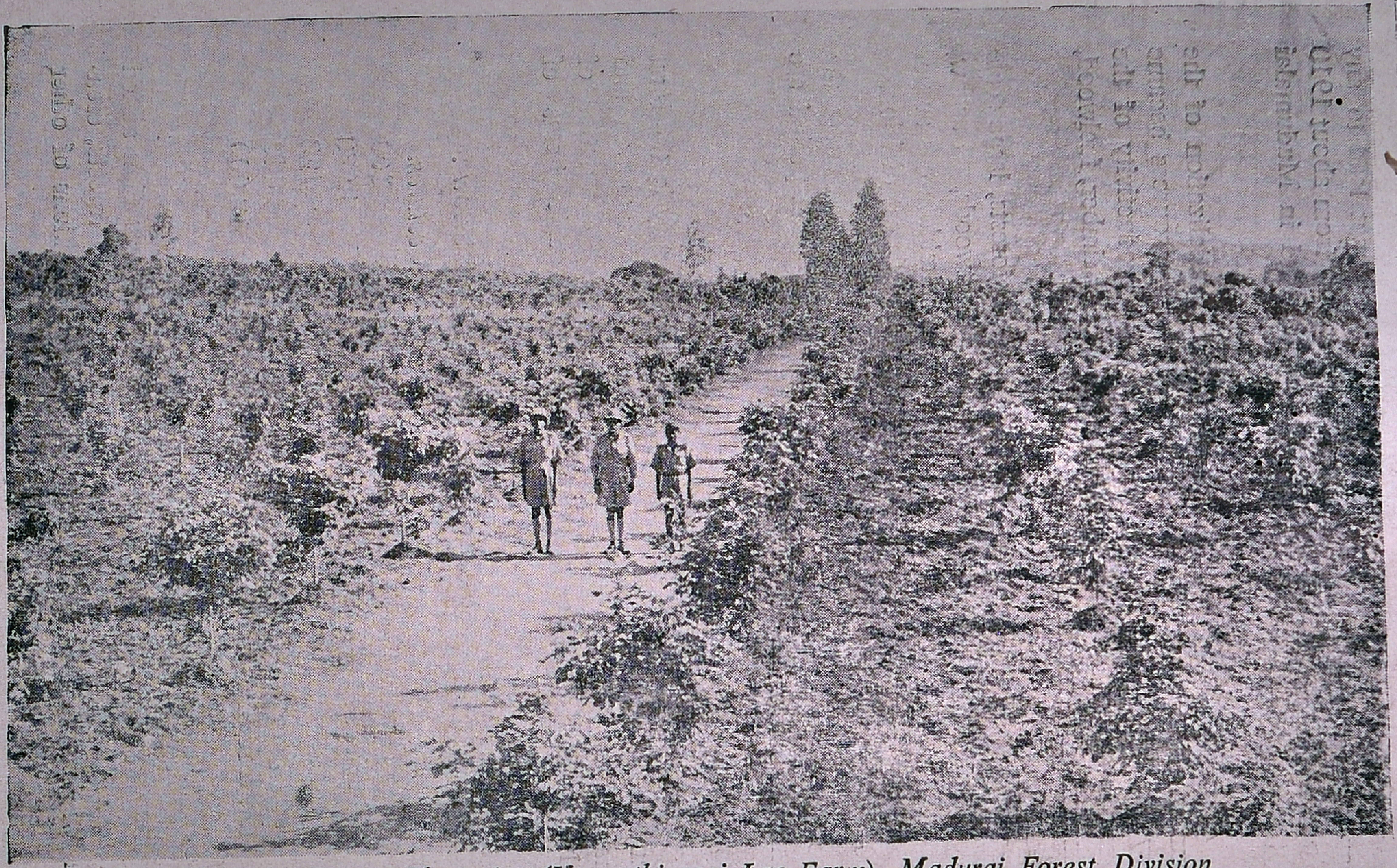
Comparatively little attention was paid to forestry in the First Plan, the total outlay being Rs. 30,43,000. Resumption and rehabilitation of ex-zamin and panchayat forests, formation of fuelwood and matchwood plantations were the chief items of works undertaken during this period.

The details of plantations raised are furnished below :—

	Hectares.
Casuarina	160
Matchwoods	1,080
Wattle	1,120
Bluegum	440
Fuel forests	12,000

Second Five-year Plan (1956-61)

The various schemes under the Second Five-year Plan aimed at rehabilitation of the denuded areas and degraded forests, creation of industrial plantations as well as plantations of other



Schleichera Trijuga Plantation (Vannathiparai Lac Farm), Madurai Forest Division commercial species and conservation of wildlife. Various soil conservation measures were also undertaken. The total expenditure was Rs. 1,47,27,000.

The details of the schemes are given in the following statement :—

Name of scheme.	*Achievements.* *Physical.*	*Achievements.* *Financial.* (RUPEES IN THOUSANDS.)
A. AGRICULTURAL PRODUCTION—		
1. Cashew cultivation (Forest areas).	18,972 hectares.	27,43
2. (*a*) Lac cultivation	137·5 tonnes	2,34
(*b*) Planting lac host trees ..	130 hectares.	
	Total ..	29,77
B. FORESTS—		
1. Preservation of wildlife ..	Rest House—1 Roads—23 km. Improvement to roads—23 km. Watch Towers—7 Salt licks—30	4,35
2. Creation of fodder banks and improvement to grazing.	4,338 hectares.	1,75
3. Creation of river, canal and lake fringe forests.	1,554 hectares.	8,88
4. Expansion of planting activities of valuable commercial timber species such as Teak.	Teak 2,065 hectares Teak (Irrigated)—244 hectares. Bamboos—186 hectares. Miscellaneous species—92 hectares.	10,16

Farm Forestry Plot (Acacia Arabica), *Madurai Forest Division*

Name of scheme.	*Achievements.*	
	Physical.	*Financial.* (RUPEES IN THOUSANDS).
B. FORESTS—*cont.*		
5. Development of matchwood plantations.	3,230 hectares.	704
6. Creation of Industrial Plantations such as Wattle and Bluegum.	Wattle—8,138 hectares. Bluegum--1,210 hectares.	21,13
7. Rehabilitation of degraded forests—		
(*a*) Afforestation of low hills.	6,497 hectares.	10,80
(*b*) Demarcation and survey of ex-zamin forests.	1,243 km^2.	
8. Development of modern techniques of timber extraction and communication.	New roads—43 km. Old roads—47 km.	6,63
9. Establishment of a Research Station in Rameswaram Island.	..	24
10. Development of Farm Forestry.	934 hectares.	95
	Total ..	71,93
C. SOIL CONSERVATION—		
1. Reclamation of eroded lands—		
(*a*) Afforestation of dry fuel forests.	24,349 hectares.	25,74
(*b*) Reconnaissance survey of eroded lands outside Reserved forests.	Five districts. ..	
(*c*) Development of fodder and pasture.	4,905 hectares.	9,36
(*d*) Construction of residential accommodation.	108	5,91
2. Extension of casuarina plantations.	1,315 hectares.	4,56
	Total ..	45,57
	Grand total ..	1,47,27

Third Five-year Plan (1961-66)

The main objectives of the Third Five-Year Plan were to raise plantations of quick growing species to meet the demands of wood-based industries, to increase the production of timber and fuelwood, and to undertake effective soil conservation measures in all the vulnerable areas forming the catchments of river valley projects.

Farm forestry and extension of forestry were taken up on a large scale in the waste lands outside reserved forest limits, with a view to fulfil the needs of the villagers for fuel, small timber, etc. Wildlife preservation and improvements to wildlife sanctuaries were given due attention. The total outlay on all the schemes was Rs. 3,72,14,000.

The details of the schemes are furnished in the following statement :—

Name of scheme.	*Achievements.*	
	Physical.	*Financial.*
		(RUPEES IN THOUSANDS).
A. CENTRALLY ASSISTED SCHEMES—FORESTS—		
1. Farm Forestry	19,340 hectares.	51,52
2. Economic plantations—		
(*a*) Plantations—		
(i) Teak	2,388 hectares.	6,30
(ii) Softwood	3,004 hectares.	6,15
(iii) Casuarina	1,416 hectares.	5,72
(iv) Wattle	6,751 hectares.	25,35
(v) Bluegum	2,542 hectares.	
(vi) Bamboos	2,225 hectares.	535
(*b*) Extension Forestry—		
(i) River, canal, lake fringe forests.	2,062 hectares.	6,43
(*c*) Rubber	1,190 hectares.	59,17

Name of scheme.	*Achievements.*	
	Physical.	*Financial.* (RUPEES I THOUSANDS).
A. CENTRALLY ASSISTED SCHEMES—FORESTS—*cont.*		
3. Consolidation (Survey and Reservation).	1,606 km².	3,58
4. Forest resources survey	..	12
5. Rehabilitation of degraded forests.	5,276 hectares.	8,68
6. Development of pasture and grazing.	482 hectares.	1,14
7. Preservation of wild life	Improvements to wildlife sanctuaries.	8,11
8. Timber operation and forest utilisation.	..	2,87
9. Training of staff	Madras State Forestry Training School.	18,99
10. Forest Research	..	4,31
11. Communication	Road—77 km. (new) Road—22 km. (old)	14,24
12. Buildings	64.	8,32
13. Amenities to Labour	..	6,07
14. Publicity	..	4
15. Protection	..	2,84
16. Raising of fuel trees	4,701 hectares.	26,15
17. Working Plans	..	33
18. Quick growing species	Bamboos—1,166 hectares. Eucalyptus—609 hectares.	15,11
	Total	2,86,89

Name of scheme.	Achievements.	
	Physical.	Financial. (RUPEES IN THOUSANDS).
B. CENTRALLY ASSISTED SCHEMES—SOIL CONSERVATION—		
1. Afforestation of dry fuel forests.	10,794 hectares.	24,49
2. Reconnaissance survey of eroded lands outside Reserved forests.	Survey completed in all districts except Thanjavur and Tiruchirappalli.	
3. Soil Conservation in Vaigai river catchments.	531 km².	1,53
4. Soil Conservation in Mettur Reservoir catchments.	1,121 km².	1,66
5. Soil Conservation in Kundah River Valley catchments.	7,231 hectares.	42,42
	Total ..	70,10
C. AGRICULTURAL PRODUCTION—		
1. Cashew in forest areas ..	5,397 hectares.	12,71
2. Lac	..	2,44
	Total ..	15,15
	Grand total ..	3,72,14

Canal Bank Plantation in Tiruchi Forest Division

SHORT NOTES ON FOREST PLANTATIONS

TEAK (*Tectona grandis*).

Teak plantations are raised in all suitable localities in the moist deciduous forests, after clear-felling the existing growth. One year old teak stumps are planted in crow-bar holes at a spacing of 1.83 metres by 1.83 metres. Periodic thinnings are carried out. The rotation is usually 70 to 80 years.

Teak is also raised under irrigated conditions, on a relatively small scale, in Mettupalayam Range of Coimbatore Central Division on a short rotation of 20 years for the production of teak poles.

In addition teak is planted along the banks of rivers and canals in the Cauvery delta. Planting is done 3·35 metres apart and the plants are watered in the first year.

Planted area—5,690 hectares.

BLUEGUM (*Eucalyptus globulus*).

Planted in the Nilgiri and Upper Palani hills, between elevations 1,800 to 2,500 metres. Plantation technique and other details are given later in this note under " The Nilgiris Forest Division " (Page 42).

Area of plantations—4,760 hectares.

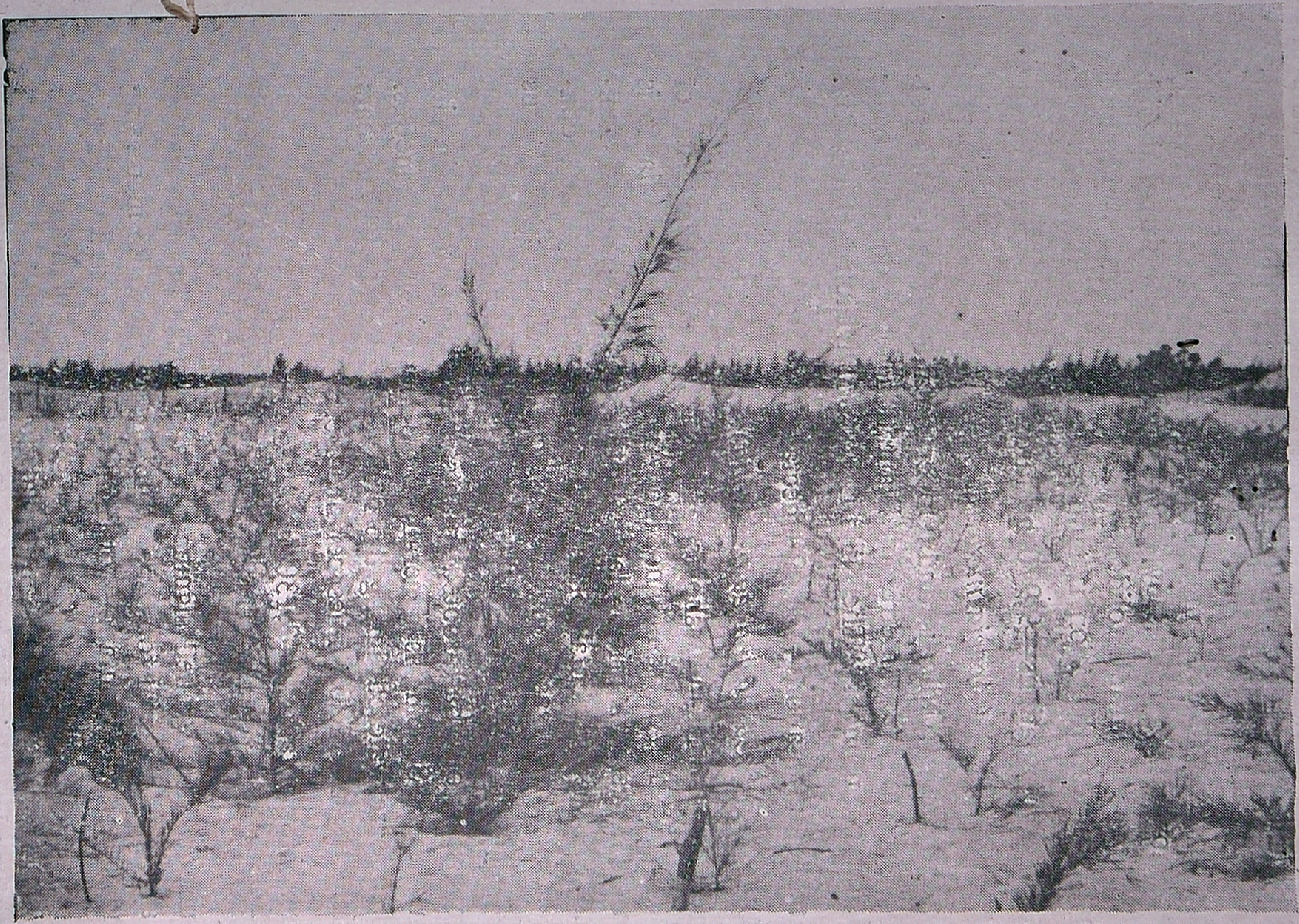
ROSEGUM (*Eucalyptus grandis*).

Large scale planting of rosegum was commenced during recent years on the Nilgiri-Wynaad plateau. Regeneration technique and other details are given under " The Nilgiris Forest Division " (Page 46).

Area planted—410 hectares.

MYSOREGUM (*Eucalyptus tereticornis*).

This was one of the several species originally tried in Nandi hills of Mysore State during the time of Tippu Sultan. It was introduced in Madras State during 1954 and since then its cultivation has spread over extensive areas in the dry zone.



Stabilization of sand dunes by afforestation Casuarina Plantation on 50 feet high dunes soil starible.

Past experience has indicated that intensive soil preparation by way of clearfelling and uprootal of existing natural vegetation and deep ploughing is an essential prerequisite for raising plantations of Mysoregum. Seedlings are raised in polythene containers and when about 25 to 30 centi metres in height they are planted in pits, 30 centi metres cube. The spacing generally adopted now is 2·5 metres by 2·5 metres. Pits are treated with termiticide like aldrin, folidol, B.H.C., etc., as a precaution against termites. Rotation is tentatively fixed at 10 years.

Area of plantations—9,970 hectares.

BLACKWATTLE (*Acacia mearnsii*).

Grown on the Nilgiris and Upper Palanis at elevations between 1,800 to 2,500 metres. Plantation technique and other details are given under " The Nilgiris Forest Division " (Page 43).

Area of plantations—16,490 hectares.

CASUARINA (*Casuarina equisetifolia*).

Indigenous on sandy shores and dunes along the coast of Burma, Malaya, Australia and the Andamans. In India it is grown extensively on private lands in the coastal regions for fuelwood. The departmental plantations in Madras State are confined over small areas along the east coast and on alluvial soils in delta tracts.

One year old bare-rooted plants are planted out in pits 30 cm. cube. Spacing is generally 2·58 metres by 2·58 metres. The plants are watered during the first year. Rotation is 7 years and yield is about 120 tonnes per hectare.

Area of plantations—3,130 hectares.

BAMBOOS

Bamboos have gained significant importance in the recent years as a raw material for paper pulp and to meet the increasing demand large scale plantations of bamboos were started under the Third Five-Year Plan. Areas proposed for plantations are mainly confined to the Hassanur plateaux in Coimbatore North and Hosur plateau in Dharmapuri district and to a lesser extent in Udayarpalayam forests of Tiruchirappalli district.

Seedlings are raised in nursery beds and when about 10-15 centimetres high, they are pricked out in transplant beds about 45 centimetres apart. Two year old seedlings are removed from the transplant beds, with rhizome, and planted out in pits. Spacing is 6 metres by 1·5 metres. Both *Bambusa arudinacea* and *Dendrocalamus strictus* are chosen for planting. Mysore gum (*Eucalyptus tereticornis*) is sometimes interplanted in bamboo plantations.

Planted area—4,750 hectares.

CASHEW (*Anacardium occidentale*).

It is an exotic from Brazil, first introduced in the south-west coast of India some 400 years ago. Large areas of private plantations exist in the coastal districts of South Arcot and Thaniavur. Cashewnut has a great export market and earns considerable foreign exchange. Cashew apple and the oil from shell are also items of commercial importance.

The Forest Department launched on large scale plantations of cashew in 1956 under the Second Five-Year Plan. Poor type of scrub-forests on red soils in the dry zone are generally selected for raising plantations. The forest growth is clearfelled and stumps uprooted. The site is ploughed and seeds dibbled in refilled pits, 30 centimetres cube in size. Spacing varies from 5 metres to 7 metres. Since the tree has a wide and spreading crown, one or two thinnings may be necessary as the crop advances in age. Cashew commences to yield from about the 4th year.

Area of plantations—26,690 hectares.

RUBBER (*Hevea brasiliensis*).

Hevea brasiliensis is a medium sized deciduous tree with straight clean bole and spreading crown. It remains deciduous for a short time in December or January and the new foliage is formed in January. The flowers appear in January-February and the fruits ripen in July-August.

The species is found to flourish best under the following ecological conditions :—

(*a*) An equable and warm tropical temperature around 30°C.

(*b*) Fairly high atmospheric humidity throughout the year.

(*c*) Evenly distributed rainfall of 1,770 to 2,540 millimetres per year.

(*d*) Deep rich well drained loamy soil.

(*e*) Elevation not much above 250 metres.

Most of the above conditions are met within some of the reserved forests of Kanyakumari district and these areas have been selected for raising rubber plantations. The area enjoys both the monsoons. The highest rainfall is in June and the next highest in October. The balance of the total annual rainfall is fairly evenly distributed during the rest of the year with the exception of two or three months between December and February which are dry. The soil is deep and well drained. Swampy and water-logged soils and slopes with shallow soils are avoided. The pH. value of the soil is between 3 and 7.

Mostly budded stumps are used for planting ; apart from this seedling stumps have also been used. The planting material used in the plantations are recognised as some of the best both in regard to yield and other characters. Some of the important clones planted are—

Seedling stumps : Tjir 1, GG 1, GG 2, HC 55, BD ', pB 86.

Budded stumps: pB 86, Tjir 1, pB 5|139, pB 6|9, GL 1, PB 107, LCB 1320, RRIM 605.

Area planted—1,650 hectares.

THE NILGIRIS FOREST DIVISION

The tract in general

Situation

The Nilgiris division covers the entire Nilgiris district except a small portion below Coonoor. The division falls between the latitudes 10°1′ N and 11°45′ N and longitudes 76°1′ E and 77°15′ E.

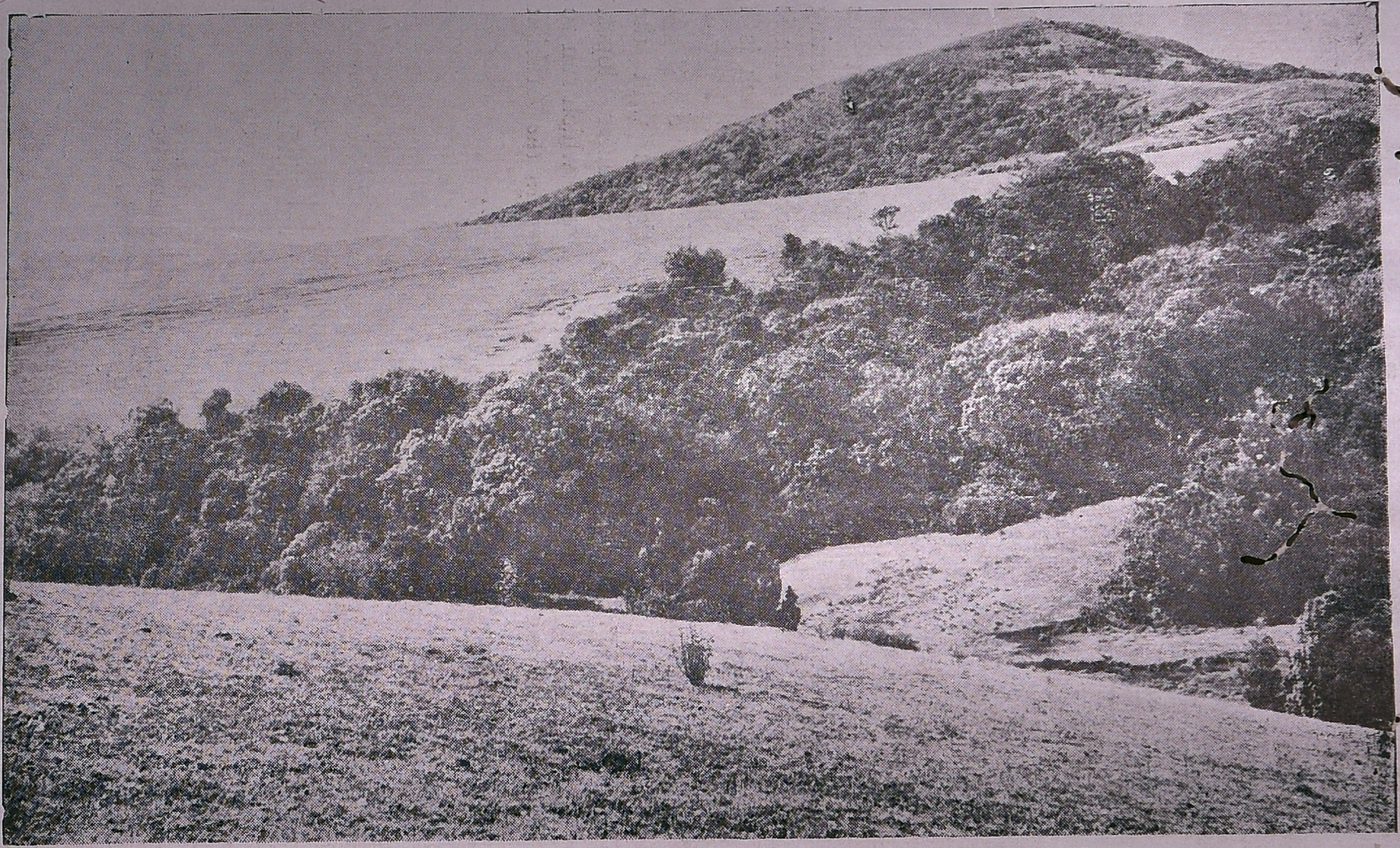
Configuration

The division includes four naturally distinct regions, viz. (1) the Nilgiri plateau which is 56 kilometres long and 32 kilometres broad with an average elevation of about 2,000 metres containing some of the highest peaks in the South, of which Doddabetta is the highest (2.633 metres), (2) the Nilgiri-Wynaad which is a lower plateau with an average elevation of 1,000 metres, lying to the north-west of the main mass of the Nilgiris, (3) the Segur plateau which is a narrow strip of land contiguous with the Nilgiri-Wynaad but lesser in altitude and (4) of outer slopes. The division is drained by the Bhavani and Moyar which run to the east and several small rivers which empty into the Arabian Sea towards the west.

Rock and soil

The Nilgiri hills consist of a great mass of foliated gneissose rocks of the class charnokite with a few later dykes of olivine-morites which have weathered into four different kinds of soils which are black, brown, yellow and red in colour and of varying depths.

The Nilgiri-Wynaad contains archean biolite and hornblendic gneiss which have given rise to two kinds of soils, viz., a black sandy loam and a red heavy loam.



Grass Land and Shola Forests, Nilgiris Forest Division

Climate and rainfall

The Nilgiri plateau has a distinctly temperate and equable climate with frosty **nights in winter and** receives from 1,000 to 4,000 millimetres of rainfall from both the south-west and the north-east monsoons. The Nilgiri-Wynaad region has a warmer climate with an annual rainfall of 1,400 millimetres to over 4,400 millimetres chiefly due to the south-west monsoon. The Segur planteau is the hottest and the driest receiving less than 900 millimetres of rainfall. The outer-slopes receive different rainfalls according to situation, the western slopes receiving the highest.

The Vegetation

The existence of a wide range of climatic, altitudinal and topographical variations has resulted in a diverse vegetation. The most important of the vegetation types are described below. The classification is according to Champion and Seth. (A revised Survey of the Forest Types of India).

A. Vegetation on the Nilgiri plateau.

(1) *The shola-grass land formation.*—The natural vegetation of the plateau consists of vast stretches of grasslands interspersed with numerous isolated, compact, sharply defined small woodlands called 'sholas'. They are classified under the "Southern Montane Wet Temperate Forests" (Sub-Group IIA|1-Type IIA|C1). The flora includes species of both tropical and temperate origin such as species of *Ternstroemiaceae* and *Lauraceae, Eugenias, Meliosma, Eurya, Symplocos, Michelia, Ilex, Euonymus, Rhododendron, Gaultheria* and *Vaccinium.* Climbers like *Rosa leschenaultiana, Toddalia asiatica* and *Elaeagnus latifolia* also occur.

There are several types of sholas which vary greatly in composition according to locality.

The grasslands consist of grasses like *Agrostis schmidii, Brachypodium sylvaticum, Bromus diandrus* and *Poa gamblei* together with a variety herbs belonging to *compositae, Gentianaceae, Ranunculaceae, Umbeeliferae* and *Rosaceae.*

(2) *Exotics.*—A few exotics have also colonised extensive tracts on the plateau. The most important of them are *Eupatorium glandulosum, Ulex europeus* (gorse) and *Cytisus scoparius* (broom).

Several species of wattle, *Eucalyptus* and conifers have been cultivated for commercial and aesthetic purposes, of which, the black wattle and the Bluegum form the important commercial crops on the plateau.

(3) *The Sub-montane forests.*—These correspond to the Southern Sub-Tropical Hill forest (Type 8A|C1). These forests occur on slopes between 1,000 metres and 1,800 metres below the frost line. The trees range from 20 metres to 30 metres. The important species are *Syzigium* species, *Meliosma* species, *Elæocarpus* species and species of *Lauraceæ*.

B. The teak forests of the Nilgiri-Wynaad.

There are a variety of forest types in the Nilgiri-Wynaad area where the altitude, soils and rainfall are conducive to a luxurient vegetation. The more important types are:—

1. West Coast Tropical Evergreen forest (1A|C4) ;
2. West Coast Semi-Evergreen forest (2A|C2) ;
3. Southern Moist Mixed Deciduous forest (3B|C2) ;
4. Southern Secondary Moist Mixed Deciduous forest (3|2SI) ;
5. Moist Teak forest (3B|C1) ;
6. Dry Teak forest (5A|C1) ; and
7. Secondary grassland.

A plethora of tropical species is found in these forests, of which the most important from commercial point of view are : *Tectona grandis, Terminalia crenulata, Pterocarpus marsupium, Lagerstroemia lanceolata, Dalbergia latifolia, Adina cordifolia, Grewia tiliaefolia* and *Bambusa arundinacea.*

C. The open deciduous scrub of the Sigur plateau.

The rainfall being poor, the area bears poor scrubs which correspond to the following forest type:—

Dry teak forest (5|Acl).
Dry deciduous scrub (5|DSI).
Dry savannah forest (5|DS2).
Laterite Thorn forest (5|E7).
Secondary Dry deciduous forest (5|2SI).
Southern thorn forest (6A|C1).
Southern thorn scrub (6A|DS1).

The important tree species are *Santalum album, Acacias, Anogeissus latifolia, Emblica, Gyrocarpus, Strychnos, Cassias, Zizyphus* species, etc.

D. The dry forests of the lower slopes.

The lower reaches of the south eastern slopes bear a dry deciduous type of forest with a good mixture of dry evergreen species and sandal in favourable localities. It degrades into a secondary thorn type of forest at lower levels.

Past management of the Forests

The Nilgiri Plateau

After the advent of the British in the early nineteenth century and after the establishment of hill stations like Ootacamund, Coonoor, Wellington and Kotagiri, the destruction of the sholas for firewood and small-wood was unprecedented. Earlier plantations of Bluegum considerably eased the fuel problem and saved the sholas. Wattle was introduced in 1832 and Eucalyptus in 1840. The Forest Act was introduced in 1882 and sholas and other areas were reserved. The planting of wattle and bluegum became an important activity on the Nilgiri plateau in later years and vast stretches of grasslands have been planted up.

The Mudumalai Forests

The Mudumalai forests constituting about 500 kilometres^2 were once the property of Thirumalpad of Nilambur. These forest were got on a 99 years lease by the Government in 1863 on an annual rent of Rs. 3,500 and subsequently were acquired and constituted as reserved forest in 1927, after paying a compensation of Rs. 1,79,899-1-7. Right from 1882, the forests have been managed according to Working Plans, the first of which was written by Gamble. Subsequent plans were drawn by Cox, Dyson, Ranganathan and Jeyadev and the latest by Thyagarajan.

Sytematic management of the Mudumalai forests was started by Gamble. They were mostly worked under selection-*cum*-improvement systems. Artificial regeneration of Teak by 'Tangya' method was starter in 1895 after a suggestion by Popert.

Sandal forests

Though initially even live sandal trees were extracted, now extraction is confined only to dead trees on a three year felling cycle.

Bamboos

The bamboos have been worked by a selection system on a five year cycle but now on a three year felling cycle. In recent years there had been heavy demand for bamboos for paper pulp.

Minor Produce

A variety of minor produces are available in the forests such as stone and tree moss (lichens), honey, wax, tamarind, deer horns, soapnut, gallnut, barks and oil yielding seeds. They are usually collected through the agency of contractors and labour co-operative societies.

Administrative set up

The Nilgiris Forest Division is under the control of a District Forest Officer with headquarters at Ootacamund. He is assisted by two Assistant Conservators of Forests, one at Ootacamund and the other at Gudalur, the latter also in-charge of the private forests.

The division has nine territorial ranges each in charge of a Range Officer. Besides, there are five range officers for plantations and on other duties.

The Division at a glance

Geographical area.—2,540 kilometres ^{2}

Area of the Reserved forests.—1,267·40 kilometres ^{2}

Plantations up to 1967–68—

	Hectares.
Bluegum	5,127
Wattle	12,262
Rosegum	445
Teak	728
Bamboos	317

Timber produced in 1966--67 2,500 m ^{3}

Sandalwood produced in 1966--67 : 38·69 tonnes.

Revenue and expenditure in rupees—

Year.	*Revenue.*	*Expenditure.*	*Surplus.*
1964-65 ..	34,59,972	17,20,981	17,38,991
1965-66 ..	23,70,981	20,65,239	3,05,742
1966-67 ..	23,56,758	22,56,302	1,00,456

The fall in revenue is due to arrears of lease amounts due from the industries. From 1967–68, the expenditure is likely to fall and the revenue to increase leaving a considerable surplus.

Notes on Important forest crops in the Nilgiris

TEAK (*Tectona grandis*).

Teak occurs naturally in the Nilgiri-Wynaad forests. The timber is obtained out of selection fellings as well as clearfellings.

Silvicultural system.—(1) Selection felling with natural regeneration.

(2) Clearfelling followed by artificial regeneration.

Rotation.—One hundred and fifty years in the selection felling areas with a felling cycle of 30 years and 70 years in the artificially regenerated stands.

Felling.—Felling is done departmentally and the timber is brought to depots at Kargudy and Mettupalayam for sale.

Artificial regeneration.—In the clearfelled areas the slash is burnt and teak stumps are planted in May in crow-bar holes at 2 metres by 2 metres under 'kumri'. In the second year *Ocimum kilimandscharicum* (camphor) is interplanted to suppress weed growth and also to obtain campher.

Tending is done up to obtain camphor.

Thinning.—Five thinnings are done. A mechanical thinning is done in the 6th year removing alternate diagonal rows leaving an espacement of 2.85 metres by 2.85 metres. Selection thinnings are done in the 12th, 19th, 27th and 36th years. At the final thinning in the 36th years about 163 trees are left per hectare.

BLUEGUM (*Eucalyptus globulus*).

Bluegum was first introduced in the Nilgiris by Captain Cotton of the Madras Engineers in 1840. Though several other Eucalypti like *Eucalyptus pilularis, E. punctata, E. eugenioides, E. propinqua, E. acmenoides, E. hemiphloia and E. crebra* were also introduced for timber, they were found to grow too fast to be of use as good timber. Only *Eucalptus globulus* has proved economically valuable as inferior timber, firewood, pulpwood and source of Eucalyptus oil.

Silvicultural characters.—Very strong light demander, frost and fire tender, susceptible to wind damage and an excellent coppicer.

Silvicultural system.—Clear felling followed by regeneration by simple coppice. After 4 rotations of coppice, the area is replanted with bluegum seedlings.

Rotation.—Ten years.

Yield.—Average—175 tonnes of wood and 120 headloads of leaves per hectare.

Regeneration.—In felled areas, the stools are allowed to coppice. In new areas container seedlings are planted at 2 metres by 2 metres in 30 centimetres cube pits with 75 grams of NPK fertilizer (6·7 per cent N, 10 per cent P_2O_5 and 10 per cent K_2O) added in each pit. Tending is done for the first two years. Wherever there is demand, the plantations are raised under ‘ kumri ’ method.

Nursery practice.—Two hundred and fifty seeds of Bluegum weigh a gram and ten grams of seeds are sown per square metre of nursery bed. The seedlings are given shade till they are pricked out when they are about 5 centimters all. Polythene bags of the size 7·5 centiemtres by 15 centimetres are used for pricking out. When the seedlings are 25 centimetres to 30 centimetres tall they are planted out.

Utilization.—Till recently the wood was used only as fuel and and cheap timber. Of late it is in great demand for rayon grade pulp and paper pulp. A rayon factory (South India Viscose Limited) has been established near Mettupalayam for which large areas of Bluegum have been set apart.

Distillation of oil from the leaves is a flourishing cottage industry in the Nilgiris. The oil is in great demand in the pharmaceutical industry.

Cost of plantation per hectare—

	RS.
First year	410
Second year	40
Third year	25
Fourth year	15
Total ..	490 or 500

BLACK WATTLE (*Acacia mearnsii*).

Several Acacias such as *Acacia dealbata, A. decurrens, A. melonoxylon* and *A. mearnsii* were introduced on the Nilgiris in the early 19th century. Of these the black wattle is the most valuable, the wood being used as pulpwood and bark for extracting tannin.

Silvicultural characters.—Moderate shade bearer, fire and frost tender and susceptible to wind damage.

Silvicultural system.—Clear felling followed by natural regeneration.

Rotation.—Ten years.

Yield.—Regulated by area ; about 7 tonnes of green bark and 75 tonnes of wood per hectare.

Regeneration.—In new areas by planting container seedlings in 30 centimetre cubic pits at 2·5 metres by 2·5 metres with 75 grams of NPK fertilizer (6·7 per cent N, 10 per cent P_2O_5 and 10 per cent K_2O) in each pit. Tending is done up to the second year.

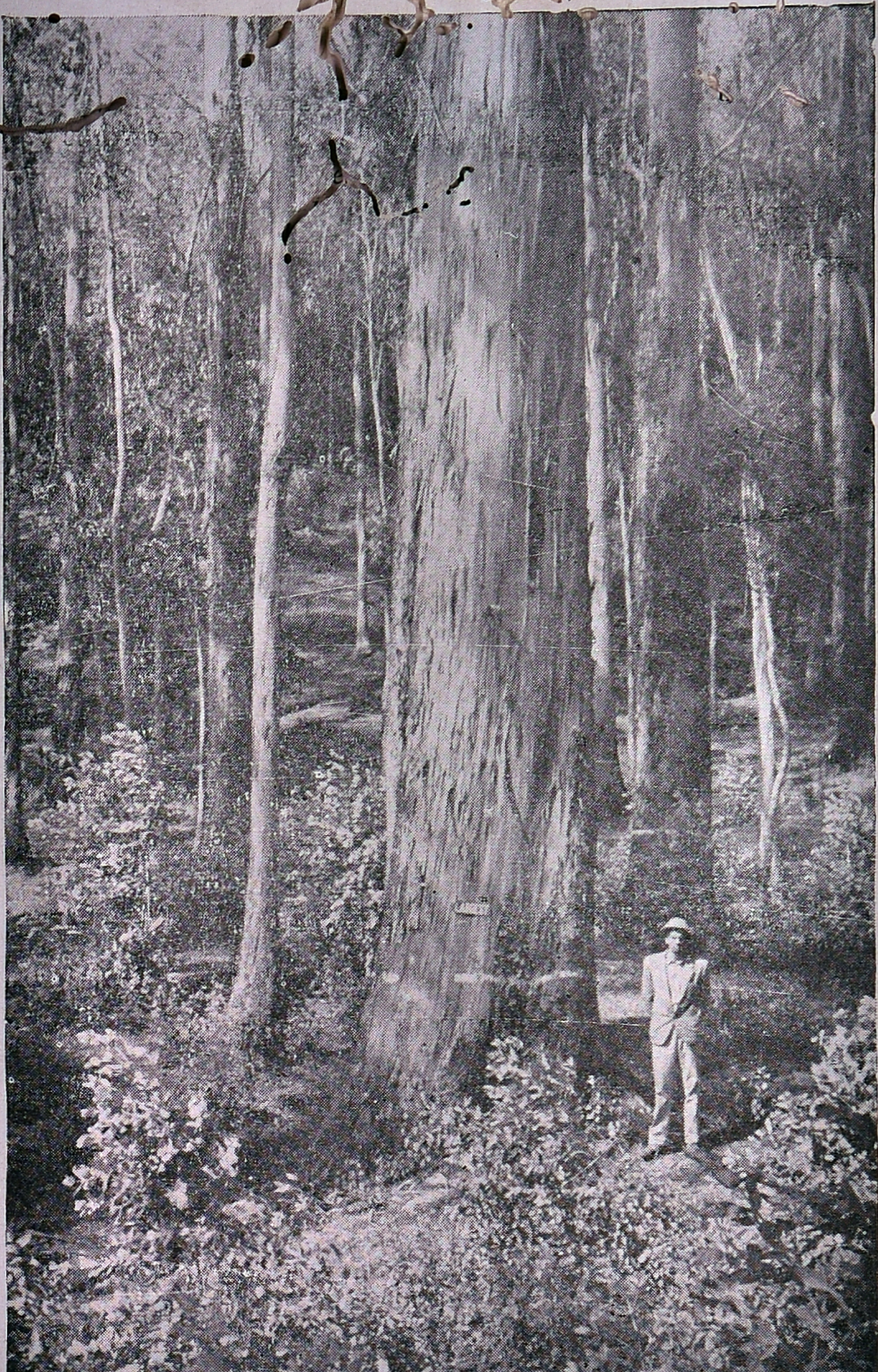
In the felled areas, the slash is burnt and profuse natural refieneration is obtained. In blanks container seedling are planted at 2·5 metres by 2·5 metres.

Nursery practice.—Seeds are pre-treated before sowing by adding to water brought to boil and allowed to remain in it for 24 hours and then washed to remove the mucilage. Seeds are sown in nursery beds of 10 metres by 1 metre at the rate of 300 grams per bed and are covered with a thin layer of earth and bracken. After germination the bracken cover is taken out and shaded by a low ‘ pandal ’. When the seedlings are 8 to 10 centimetres tall, they are pricked out into polythene bags of 7·5 centimetres by 15 centimetres. Each m^2 of nursery bed gives about 250 seedlings.

Utilization.—The bark contains about 35 per cent of tannin. A factory (Tan India Wattle Extracts Limited) has been established at Mettupalayam for which the entire wattle from the forests of the Nilgiris is reserved.

Cost of plantation per hectare—

	RS.
First year	225
Second year	25
Third year	15
Fourth to Tenth year	10
Total ..	275



Largest Bluegum Tree in the Nilgiris—Arambyshola Preservation Plot

ROSEGUM (*Eucalyptus grandis*).

Rosegum was introduced in the Cherambadi area (Nilgiri-Wynaad) in the year 1964. Since the rate of growth is very promising, it is proposed to raise the species over large areas at elevations 1,000 to 1,500 metres. Grass-lands and areas with sparse jungle growth are chosen for planting with rosegum.

Nursery.—Seeds are sown at the rate of 2 grams per square metre and covered with a thin layer of earth and bracken fern. Insecticides and fungicides are applied. When the seeds germinate the bracken covering is removed and the seedlings are provided with shade. When the seedlings are about 5 centimetres tall, they are pricked out in polythene bags of 20 centimetres by 10 centimetres size. Each m^2 of nursery bed gives about 600 seedlings.

Planting technique.—Pits 30 centimetre cube are dug and mixed with 200 grams of fertilizer (5·5 per cent N 8·3 per cent P_2O_5 and 11 per cent K_2O and 100 grams of lime. The seedlings are planted at 2·5 metres by 2·5 metres. Termite attack is a serious problem in these areas. Various chemicals like chlordane, hepatchlor, dialdrex, etc., have been tried. Of late aldrin 5 per cent is used with good results.

The rotation age and the future use of rosegum have not yet been decided. It is an excellent pulpwood.

Cost of plantation per hectare—

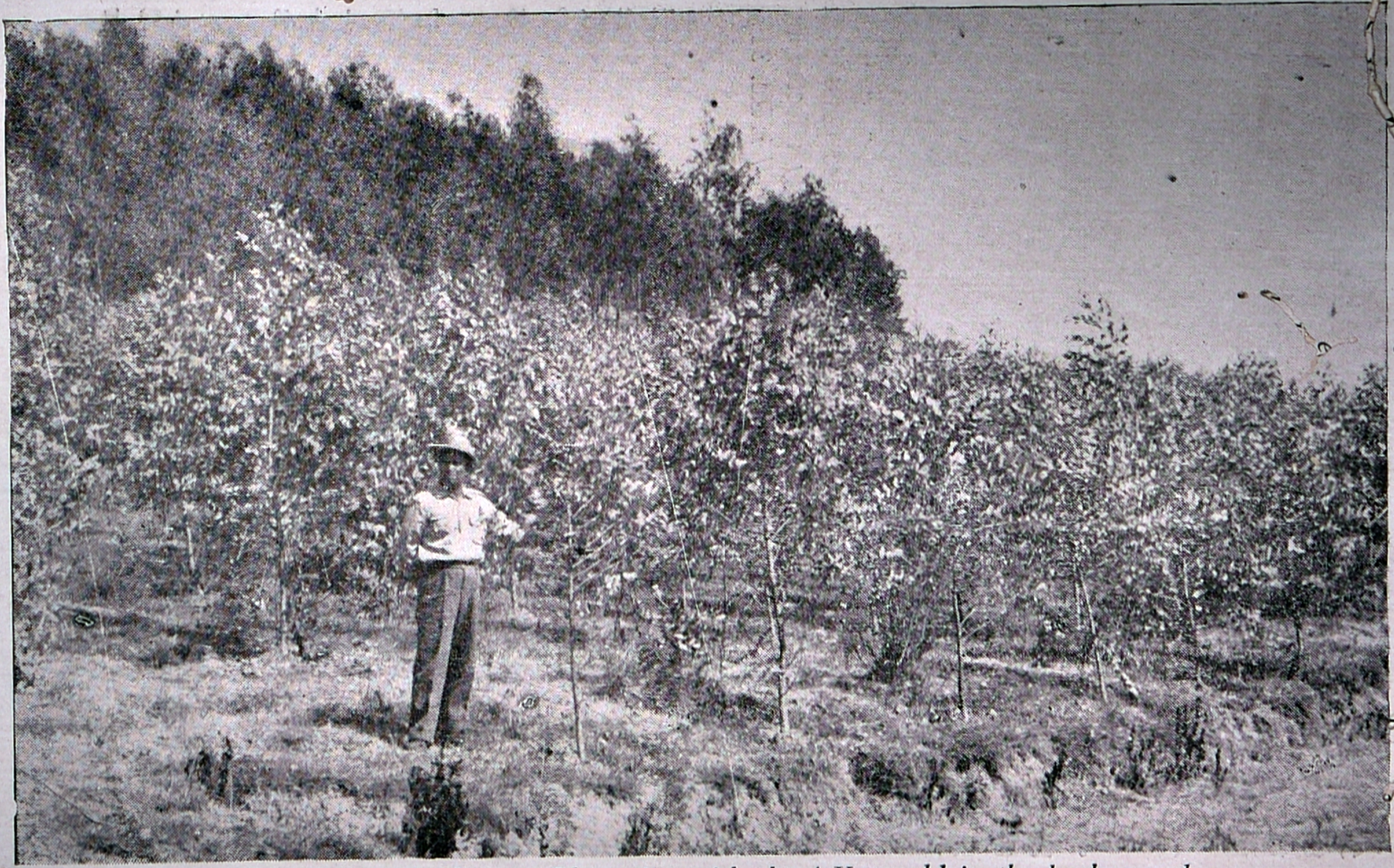
	RS.
First year	525
Second year	70

Third year onwards—not yet worked out.

Places of visit around Ootacamund
(22nd January 1968)

1. *Bluegum tree incremental plot* (1·28 *hectares*).

Planted in 1863 at 1·8 metres by 1·8 metres. The increment plot was formed in 1913 at the instance of Troup. There are 73 trees at present, the tallest of which is tree No. 48 measuring



One-Year old Bluegum Plantation with the 4-Year old in the background.

74·9 metres (245 feet) and the thickest is tree No. 53 measuring 5·64 metres (18 feet 6 inches) at breast height. The trees continue to grow and measurements between 1954 and 1962 indicate that the crop had put on a current annual increment of 26 m³ per hectare during this period.

2. *Brookhampton Bluegum plantation of* 1954.

This was planted at 3·35 metres by 3·35 metres under 'kumri' method in an area cultivated with pyrethrum. It is being worked by Messrs. South India Viscose Limited after which the area will be allowed to coppice.

3. *Muthinad Bluegum plantations.*

These plantations were raised in 1964, 1965, 1966 and 1967.

1964—(28·73 hectares) : Mossed seedlings were planted at 2 metres by 2 metres and the area was very badly affected by forest between 1964 and 1966. The cost up to 1967 is Rs. 317| hectare.

1965—(20·23 hectares) : Raised under 'kumri' and planted with mossed seedlings at 3·5 metres by 3·5 metres. There were heavy casualties due to frost which were replaced up to 1966. Due to heavy manuring and intensive soil working by 'kumridars' the seedlings show a vigorous growth. The cost up to 1967 is Rs. 28·25 per hectare.

1966—(18·72 hectares) : This was also raised under 'kumri' method and planted with container (polythene) seedlings at 3·5 meters by 3·5 metres. Casualties have been replaced in 1967. The effect of heavy manuring and intensive soil working is evidenced by the fast growth of the plants. The cost up to 1967 is Rs. 106 per hectare.

1967—(21·57 hectares) : This was originally a grass land. Planting was done departmentally using container plants at 2 metres by 2 metres. NPK fertilized was applied at 75 grams per plant. The cost of Rs. 218 per hectare.

4. *Trial plots of Pines and Eucalyptus spices*—

Species.	*Area in hectare.*	*Year.*	*Number of plants.*	*Espacement.*
1. *Eucalyptus tereticornis.*	4	1959	6,150	2·4 m. by 2·4 m.
2. Do.	2	1960	1,800	3·5 m. by 3·5 m.*
3. Do.	1·2	1960	1,000	2·4 m. by 2·4 m.
4. *Pinus insignis* (*syn P. radiata*).	0·4	1961	325	3·35 m. by 3·35 m.
5. *P. khasia* ..	1·9	1962	2,875	2·59 m. by 2·59 m.
6. *P. insignis* (*Syn. P. Radiata*).	1·9	1963	2,850	2.59 m. by 2.59 m.

* *Fertilizers trials.*

5. *Glenmorgan wattle plantation of* 1956 (143·2 *hectares*).

Mossed seedlings were planted at 3·35 metres by 3·35 metres in 30 centimetres cube pits with 56 grams of wattle fertilizer per pit. The cost up to 1967 works out to Rs. 134 per hectares.

6. *Central Nursery at Pykara*—

This nursery is in existence since 1954 mainly for raising blugum and wattle seedlings. Thirty concerete beds with permanent ' pandals ' have been formed for purposes of storing the container seedlings. Each bed can accommodate 6,000 polythene containers, 7·5 centimetres by 15 centimetres each. The pandals are provided with coir mats. A concrete bed with pandal costs Rs. 300, and coir mat Rs. 52.

7. *Eucalyptus grandis plot* (0·40 *hectare*)—

This is a privately owned plantation. Raised in 1952 at an espacement of 3·66 metres by 3·66 metres (12 feet by 12 feet) and is now used as a seed plot.

Kariamund

This is a typical hamlet of the Todas (or Toduvars) who are the early inhabitants of the Nilgiri plateau. They are a pastoral people herding large buffaloes. They live in quaint arch-roofed huts with small entrances through which one has to necessarily go down on all fours.

The Todas practice unusual customs like polyandry, and buffaloe sacrifices at their funerals. They speak a language which has similarities to Malayalam and Tamil. The Todas have been the subject of considerable anthropological interest and ethnographic enquiry.

MUDUMALAI WILD LIFE SANCTUARY

If there is one place in India where one can view with comparative ease a single herd of more than four hundred spotted deer, seventy to eighty gaur (Indian Bison), and forty to fifty elephants, that place is Mudumalai Wild Life Sanctuary in the Nilgiris district.

Mother Nature has been extermely lavish in providing this sanctuary with thickly wooded hills, plateaus, deep valleys, waterfalls, rivers, streams, marshes and salt licks. The varied flora and topography not only meet the ecological requirements of several species of animals inhabiting this area but fill the heart of the visitors with joy.

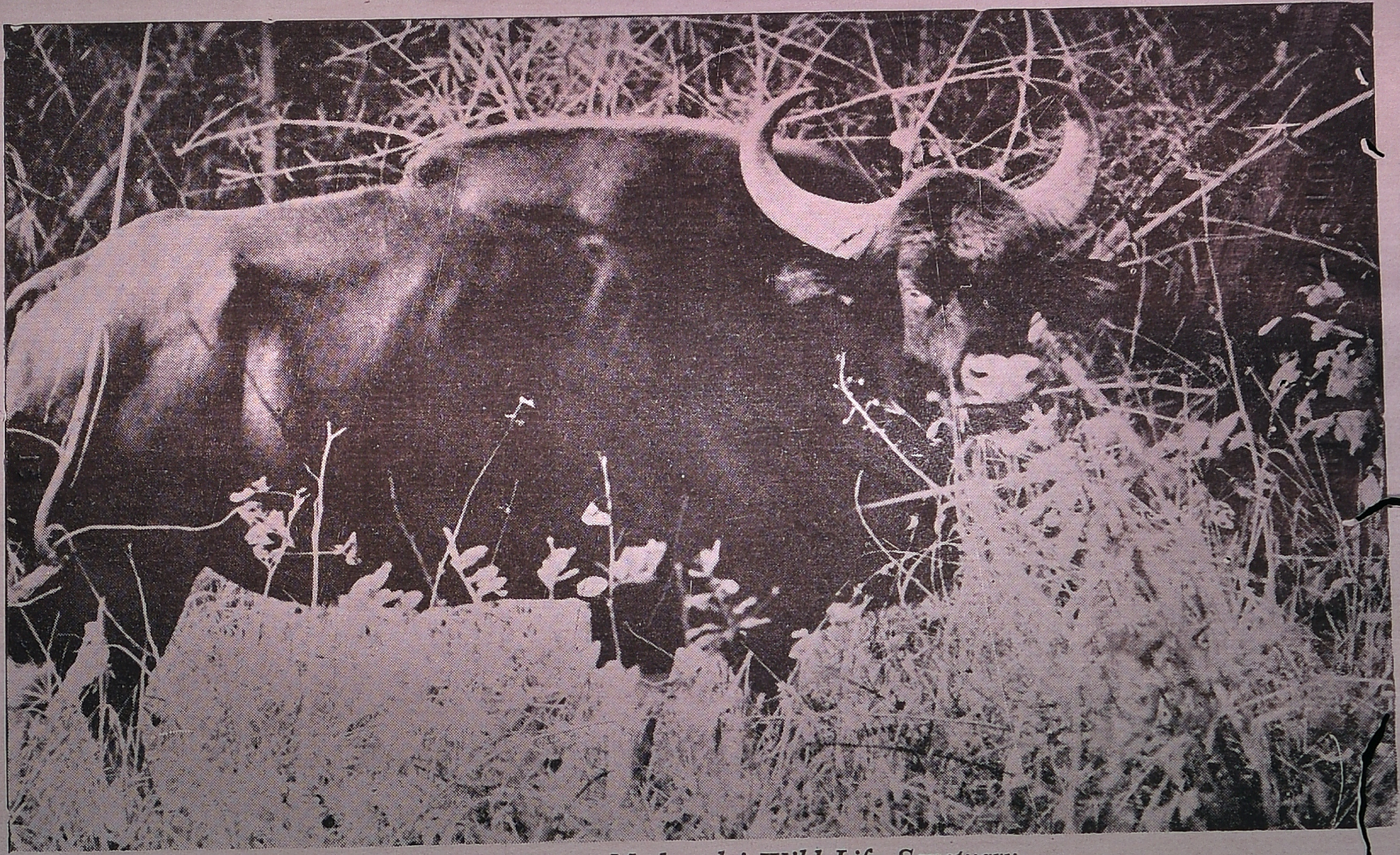
Extent and location

The sanctuary which is 124 square miles in extent shelters a variety of wild life, typical of the Indian Fauna. Here the animals roam about with perfect freedom. It is sanctum sanctorum in the truest sense ; Nature's greatest temple to which hundreds of devotees of Nature from all parts of the World are attracted. This is a meeting place of the east and the west. Tourists from every country in the world visit Mudumalai Wild Life Sanctuary.

The Ootacamund-Mysore Road passes through the Sanctuary which is 40 miles from Ootacamund and 60 miles from Mysore. The nearest Air-port is Coimbatore and the nearest Railway Station, Ootacamund. There is daily bus service from Ootacamund to Mysore. The bus stops at Abhayaranyam Rest House and also at the Office of the Range Officer, Wildlife No. 1.

Visitor facilities

There are three Rest Houses, Abhayaranyam, Kargudi and Masinagudi provided with all the modern amenities such as electricity, running water, beds and refrigerators. There is a cook attached to each Rest House, who serves both vegetarian



A Lone Gaur—Mudumalai Wild Life Sanctuary and non-vegetarian meals. Reservations for joy rides, accommodation and food can be made by advance booking and payment. The charges are moderate.

To enable visitors to view wildlife with ease and comfort, tree top machans and observation towers have been built in suitable places amidst natural surroundings overlooking salt licks or water holes frequented by animals. A Swiss couple, who spent the night in one of the machans witnessed a fight between a Tiger and a Panther at the water hole. Elephants for joy rides are provided besides a Jeep and a Van.

The best period to visit the Sanctuary is between February and May when the tall elephant grass dries up increasing the visibility of movements of wild animals. The most suitable time to go round the Sanctuary is between 6 and 9 in the morning or 3 and 5 in the afternoon. During the noon the animals have their siesta.

The Fauna

Mudumalai shetlers all forms of wildlife, Mammals, Birds, Butterflies and reptiles.

The herbivores include Elephants, Gaur, Sambar, Spotted deer, Barking deer, Four-horned Antelope, Mouse deer, Bonnet Moneky, Common Langur, Giant Squirrel and the Flying Squirrel.

The Carnivores consist of Tiger, Panther, Wild dog, Jackal, Mungoose, Wild cat, Civet cat, Rusty spotted cat, Ratel and the Leopard cat.

The Omnivores are represented by the Sloth bear, Wild Bear and the Porcupine.

Giant Squirrels, Common Langurs and Bonnet Monkeys visit the Office of the Range Officer, Wildlife I for snacks. They have become so tame, particularly Giant Squirrel, that the visitors handle and pet them.

One of the most primitive mammals in the Sanctuary is the scaly Ant-eater or Pangolin, nocturnal in habits, perhaps the only

Barking Deer—Mudumalai Wild Life Sanctuary link now surviving between reptiles and mammals. It has the scales of a reptile and the behaviour of a mammal.

Not the tiger but the blood thirsty wild dog, hunting in packs and bringing down deer at the end of a hot chase, is the most dreaded beast of prey.

The distribution of reptiles is as interesting as it is varied. Noteworthy among the reptiles are the Python, the largest of the reptile now surviving, Rat snake, Monitor Lizard, Tortorise, Flying-Lizard, and a host of other small reptiles. The largest Python measured in the sanctuary was 17 feet.

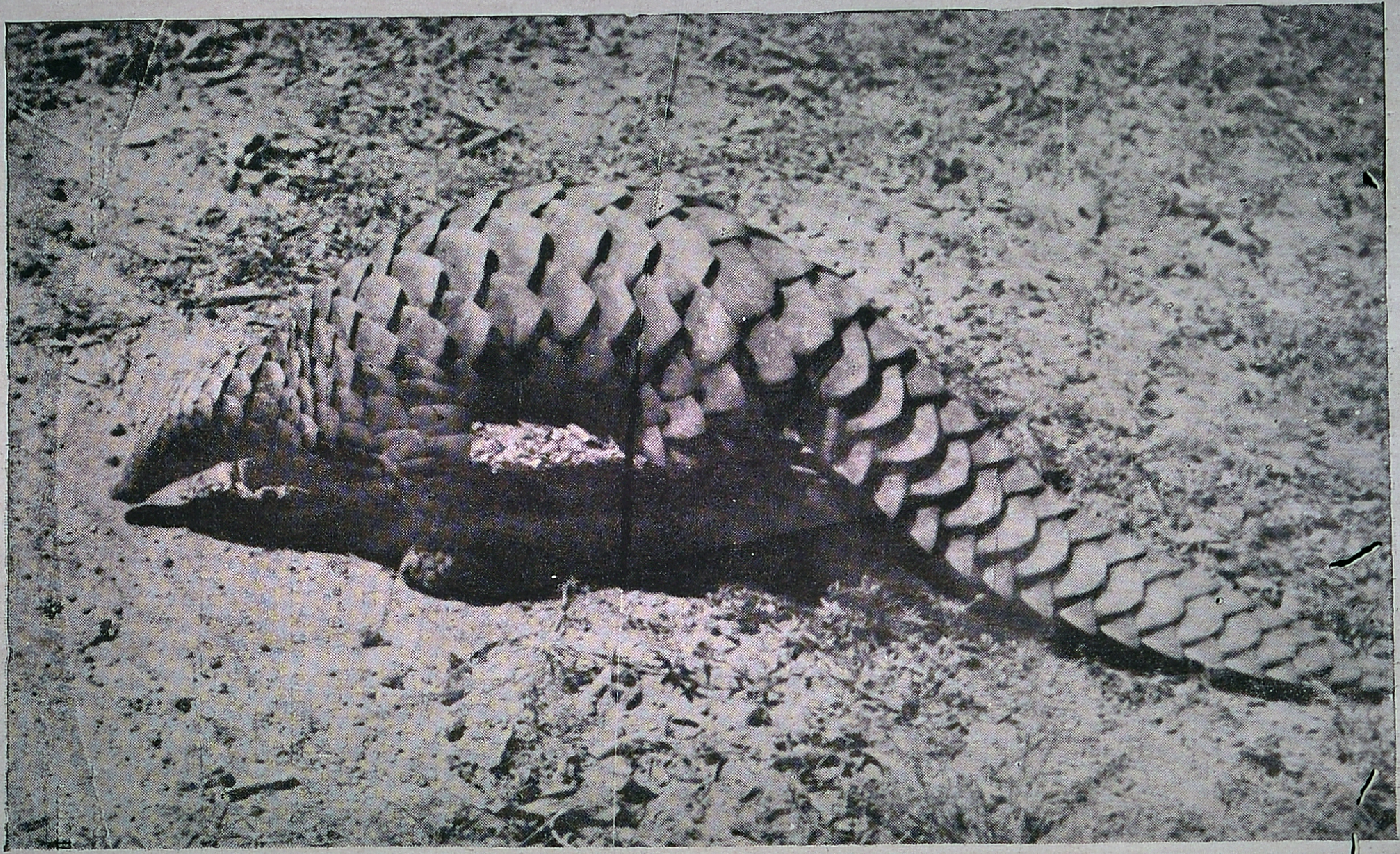
The Moyar river meandering through the Sanctuary is a reservoir of fish. Otters are not uncommon. Crocodiles are seen now and then in the deeper reaches.

Unique avifauna

The Sanctuary is gifted with a rich incidence of bird life, Upland Game birds as well as birds of brilliant plumage and song. The game birds consist of Grey Jungle, Fowl, Spur Fowl, Grey Partridge, Painted Quails, Woodcock Doves, Blue rock Pigeons, Imperial Green Pigeon, Jerdons Imperial Pigeon and the Common Green Pigeon.

Racket Tailed Drongos, Paradise Fly Catchers, Hornbills, Golden Backed Wood Peckers, Malabar great Black Woodpecker, Blue Winged Parakeets, Golden Orioles, Fairy Blue Birds, Orange bellied chloropsis, Scaly bellied Green woodpecker, Red Starts, Orange Minivets, Nuthatches, Shrikes. Bee Eaters and countless other birds lend charm and colour to the Sanctuary while the Whistling School Boy, Shama, Common Iora, Laughing Thrush and the Grackle entertain the visitors with their melodious notes and sweet songs.

Grackle or the Hill Myna is the best talker among avians. Parties of Hill Mynas can be seen throughout the year on the tall trees particularly silk cotton trees. This bird is highly priced. It costs as much as $ 80 in United States of America and Canada.



Scaly Ant-eater—Mudumalai Wild Life Sanctuary

The Wood cock which is reputed for his non-stop flight from the Himalayan region to the Nilgiris during winter stays here till the end of February.

Parties of Peafowls, can often be seen in the vicinity of Abhayaranyam Rest House, along Masinagudi-Moyar road and Jeyadev Avenue both in the mornings and evenings.

Amidst the avian chorus and dazzling flights at the break of dawn, the visitor as he enters the Sanctuary forgets himself, till he is reminded at noon about the monotony of life by the loud monotonous call of the solitarily perched small green Barbet whose call increases in intensity and volume as the day advances drowning any semblance of sound in the area.

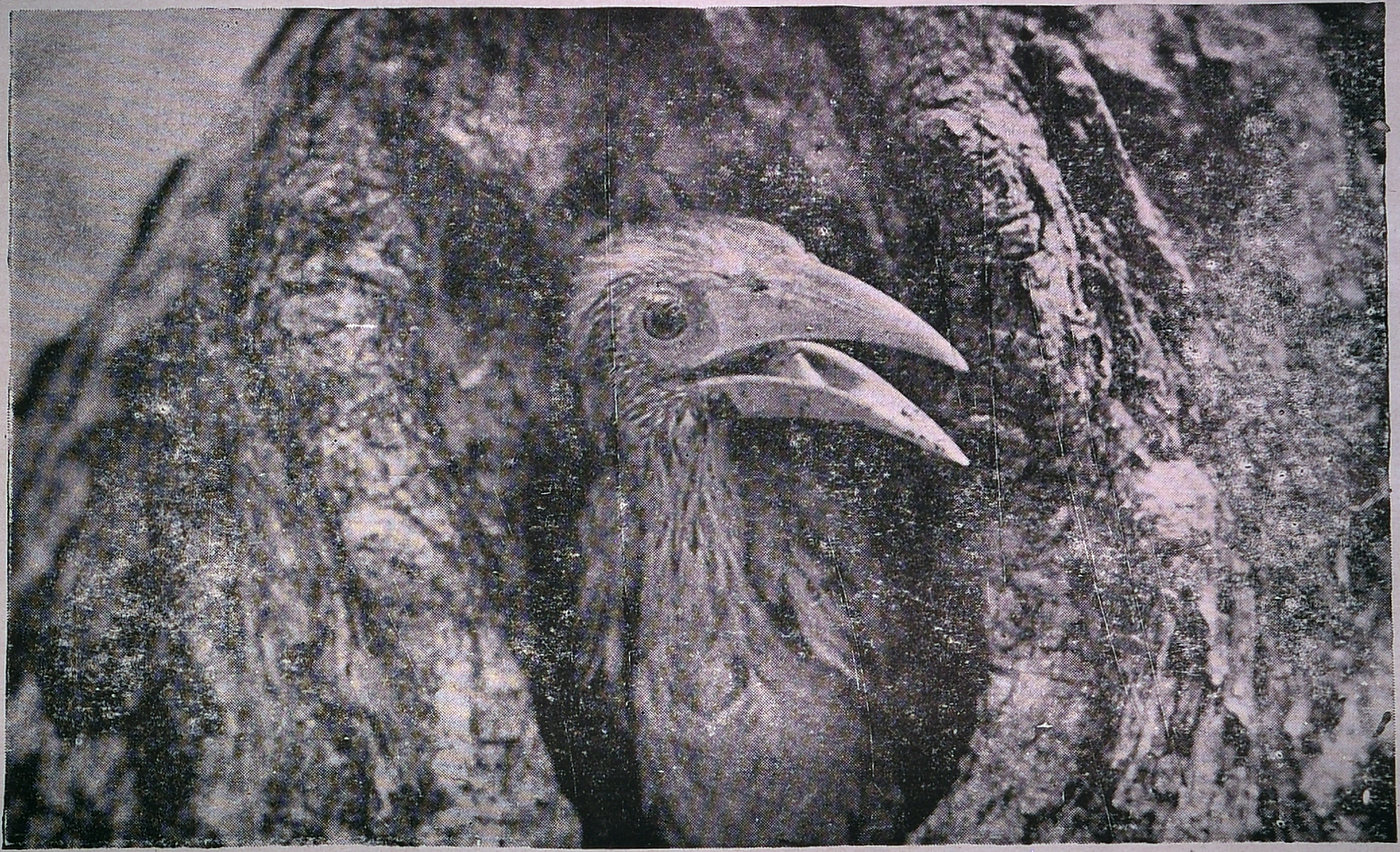
Best time for bird watching

For the bird watchers and those interested in recording bird songs, February to June are the best months which is the breeding season. The avian melodies are best heard during the courtship period when the Cock birds pour out most liquid notes to attract the hen birds.

Haunts

Mudumalai Sanctuary is divided into four blocks, namely Mudumalai, Theppakadu, Doddakatti and Benne. Heavy concentration of Elephants and Gaur are found in Benne and Theppakadu blocks. Sloth Bear and Four horned Antelopes in Daddakatti. Mudumalai, Moyar and Avarahalla Reserves attract most species of wildlife.

Herds of spotted deer, Sambhar, Elephants and Gaur could be seen as one rides along Jeyadev Avenue. Tiger, Panther and Wild dogs can be seen any where in the Sanctuary. If you are lucky, you may see a tiger or a panther crossing the road even in day time. Several visitors have seen them during the day. Dens of tigers, Panthers, Sloth Bears, Wild dog and burrows of Porcupine have been located.



Nest of Grey Hornbill—Mudumalai Wild Life Sanctuary

Saltlicks

There are more than hundred saltlicks in the Sanctuary. The saltlicks and the feeding grounds around Abhayaranyam and Kargudi Rest Houses attract Gaur, spotted deer, Sambhar, Wild boar and Porcupine. . Tigers and Panthers often lurk in the vicinity of these saltlicks to pounce upon the prey.

Butterflies

The gayest inhabitants of the Sanctuary are the butterflies. Surely you cannot come across a more varied, colourful and fascinating collection of butterflies anywhere in the State except Kodaikanal, Kallar and Nadgani Ghat. You will meet here most varieties of butterflies from the Banded peacock to Birdwing. There are about 360 species of butterflies in South India out of the total of 1,400 in the Indian Union. Many species peculiar to South India can be seen in the sanctuary. The variations in the races is so subtle and intricate that some species have been named after Tamilnad like the Tamil Lacewing, Tamil catsey, Tamil Yeoman and Tamil Bush Brown, etc. These species are much sought for by the butterfly enthusiasts.

The great herds

Herds of gaur, the largest of the bovines now surviving in the world, are the greatest attraction. Many biologists from foreign countries visit Mudumalai to study the animal behaviour particularly the gaur, elephant and Langurs. The majority of the visitors do not appear to be fully satisfied unless they catch a glimpse of these great herds at close quarters. From an elephant back, the visitors can view these huge herds from a close distance provided absolute silence is maintained. The tranquility, stillness and discipline that prevail among these herds are remarkable. Gaurs are the least noisy of the mammals and rarely they low. The discipline is such that at noon when the leader of the herd settles down for rest, the rest follow suit.

It is quite astonishing how comparatively tame and fearless these wild animals could become through years of realization that the sanctuary is indeed a haven of safety for them from their arch enemy, the man. Herds of spotted deer and Gaur will be standing close to the roads and foot paths looking curiously at the visitors. It is a constant source of wonderment how tame and friendly these animals can become when given the opportunity. Sometimes the elephants barely condescent to move off the main highway passing through the sanctuary in the face of coming traffic resulting in traffic jams and hold up of buses.

Fairyland

The nights in April are most fascinating when the whole area is illuminated with millions of glow worms (fire flies) giving the Sanctuary an appearance of a Fairy land.

Scenic spots

Besides animal life there are many places of scenic beauty in the Sanctuary which the visitors should not miss particularly the magnificient waterfall in compartment 8 of Theppakadu Block and the view point near Kargudi Rest House commanding a panoramic view of the hills and dales around.

Elephant camp

A visit to the elephant camp at Theppakadu is a must for the visitor. The playful young elephant calves are a source of delight to all the visitors whether young or old particularly during the feeding time.

Visitors

That this Sanctuary is extremely popular both with the home and foreign tourist can be vouched from the fact that on an average 4,000 visitors pay their admission fees annually. Most foreign visitors, however brief their stay may be find time to visit Mudumalai.

It is difficult to believe the evidence of one's own eyes, that about forty miles from a thriving City, Ootacamund, popularly known as the Queen of the Hill Stations, such a profusion and diversity of wildlife can still exist.

TAN INDIA

Raw material

The principal raw material for the process is the wattlebark. Substantial acreages of plantations exist in Ootacamund and Kodaikanal areas under the control of the Madras Forest Department. The Company has entered into an agreement with the Government whereby it has exclusive right for peeling and utilising the bark from the wattle plantations. It is estimated that the total area under wattle plantation would be around 35,000 acres in the Nilgiris region and 10,000 acres in the Kodaikanal region. The bark is peeled and transported to the site by road.

Process

The raw bark is cut into smaller pieces in the chipping machines. These machines are designed to handle the bark both in the dry as well as wet state. The chipped bark is lifted pneumatically to the top from where it is fed into a battery of diffusers.

The diffusers made out of stainless steel, have a filling dome and a hydraulically operated bottom door. The units are operated in series. The extracting medium, hot water in our case, is pumped from one diffuser to another and the extracting medium progressively picks up the soluble matter from the bark. The overflow from the last unit in the series is sent to the filter for further processing.

The weak overflow is concentrated in two separate units into the final form of 80 per cent solid extract. These units are operated under vaccum to avoid heating the liquor to elevated temperatures which is harmful for the product.

The waste or spent bark from the diffusers is dumped out, the units washed and made ready for receiving a fresh charge.

Output and other details

The plant is rated to produce 3,750 metric tonnes anually.

Due to the corrosive action of tannic acid all equipment and pipelines coming in contact with tannic acid are made out of stainless steel.

Messrs. B.M.A. of West Germany supplied the various equipments. The erection and initial operation of the plant was done with indigenous skill.

This is the only factory of its kind in Asia and its product is an important foreign exchange saver now and likely to earn foreign exchange in the near future.

SOUTH INDIA VISCOSE

Introduction

In the year 1955 the Government of India invited a team of Italian Experts to study the potentialities in India for setting up a Rayon Grade Pulp Unit and a Rayon Manufacturing Unit. This team reported that Bluegum (*Eucalyptus globulus*) was the most suitable wood available in India for the commercial production of rayon grade pulp and that it is available in suitable quantities in the Nilgiris. Based on this report the leading Textile Manufacturers in South India promoted the South India Viscose Limited with the active collaboration of Messrs. Italviscosa, Eastern Trading S.P.A., Milano, and with necessary assistance from the Government of India and the Government of Madras. This is an integrated Project with a rayon grade pulp unit and a rayon manufacturing unit. Both the units are located within the village limits of Sirumugai in Coimbatore district where adequate water-supply is available from the Bhavani river. (Total requirement of water is estimated to be about 13 million gallons per day.)

The Rayon Factory was started in the year 1961 for the production of staple fibre and rayon yarn with a production capacity of 10 tons of staple fibre and 10 tons of rayon yarn per day. Now the Company is putting up a Pulp Factory. The proposed initial production capacity of the Pulp Factory is 60 tons per day which will be increased to 100 tons a day. The Pulp Factory is scheduled to be commissioned before the end of the year 1968.

Wood supply

With considerable foresight the Forest Department of Government of Madras have raised large scale plantations of Bluegum (*Eucalyptus globulus*) and Black wattle (*Acacia mearnsii*) with a view to feed the forest based industries. Although Bluegum wood will be preferable to wattle for the production of rayon grade dissolving pulp, blending of a certain quantity of the latter (up to 25 per cent) could be done without affecting the quality of the product. For the 60 tons pulp plant, producing annually about 21,000 tons of dissolving pulp, over 50,000 tons of bone dry pulp wood are required. The Nilgiris Forest Division has at present over 15,000 acres under Bluegum plantations and 30,000 acres under Wattle. The current Working Plan for the Nilgiris Forest Division provides for the increase in the area under Bluegum to 20,000 acres. The South India Viscose has entered into an agreement with the Forest Department for the supply of Bluegum and Wattle wood from these plantations to their factory. The agreement also covers the wattle plantations of the Upper Palanis (Kodaikanal) in the Madurai North Forest Division where there are about 15,000 acres of wattle plantations.

Pulp manufacturing process

The well grown Bluegum and Wattle trees are felled, debarked, logged to convenient sizes and transported to the Pulp Mill where they are chipped into small pieces in chipping machines. The wood chips are cooked with *calcium-bi-sulphite* in cylindrical digesters (Sulphite process). The cooking process continues for a specified time under controlled temperature and pressure. By this the constituents of the wood are broken down and the lignin and non-fibrous matter are separated from the cellulose. The cellulose fibres thus obtained at this stage are thoroughly washed to eliminate any excessive chemicals, coluble matter, etc. The washed pulp is passed over screens which eliminate unwanted materials. It is then bleached, washed and spread over wire mesh for forming sheets. The sheets are pressed between hot rotary cylinders at the end of the drying machines. Pulp sheets of uniform thickness and of even moisture content are obtained and they are cut into required sizes.

Manufacture of rayon yarn and staple fibre

Rayon pulp has a high degree of purity with over 90 per cent of alpha cellulose. It should be free from pentosan, hemicellulose, legnin, etc. Ash content should be as low as possible.

In the manufacture of rayon yarn and staple fiber *rayon pulp sheets* are treated with caustic soda resulting in *Alkali cellulose* which is made to react with carbon-di-sulphide resulting in an orange coloured substance called *Cellulose Xanthate*. This latter is dissolved in dilute caustic soda producing a honey like liquid of the consistency of axle greece known as "Viscose". The viscose solution is ripened, de-aerated and filtered form impurities. Pressure is then applied forcing the viscose solution through spinnerettes in the form of cups made of platinum and gold with minute orifices. These spinnerettes would correspond to the spinnerettes of the Silk-worm or the spider. The spinnerettes are immersed in an Acid bath and hence the extruded solution coagulates and regenerates itself into continuous cellulose filaments known as "*Viscose Rayon*". This is either cut into fibres to give staple fibre of specified lengths (1½ inches) or collected as continuous filaments in the form of Rayon Yarn cakes. The fibres are washed, bleached and dried and opened out. The staple fibre is used like cotton in the Textile Mills. The dried yarn is marketed in the form of cakes, cones and hanks. Rayon yarn with its bright lusture resembles silk and is used in the manufacture of colourful and attractive fabrics like satin, crape, velvet, etc.

Conclusion

The South India Viscose is the result of the successful establishment of man-made forests geared to the needs of the industry in India which is a wood deficit country. Like any other Pulp Industry capital requirements are high in this and specialised skills are needed here. This Industry produces rayon pulp of high value from indigenous raw material of low value. When the Pulp Factory of the South India Viscose goes into production it would save foreign exchange to the tune of about 3 crores of rupees annually to this country.

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